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Motivating Urban Middle School Math Students While Considering their Attitudes and Perceptions

Benjamin F. Harper III
The College at Brockport, bfarper4@gmail.com

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**Motivating Urban Middle School Math Students While Considering their Attitudes
and Perceptions**

by

Benjamin F. Harper III

December 1, 2004

A project submitted to the

**Department of Education and Human Development of the State University of New
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Master of Science in Education**

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and Perceptions

by

Benjamin F. Harper III

APPROVED BY:

Conrad Van Voorst
Advisor

12/3/04
Date

2nd Reader

Date

John N. Sine
Director, Graduate Studies

12/7/04
Date

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Introduction

My rationale for conducting this research is simple: I want to further my understanding of what I can do to motivate my eighth grade math students and elicit positive attitudes and perceptions toward teachers, peers, and the learning of mathematics. Although it is my objective to learn how to positively influence all people, I will focus this research as it applies to my eighth grade students.

To better understand the research that follows, the reader must understand my experiences as a teacher. I'm an African-American eighth grade math teacher at Frederick Douglass Preparatory School, a middle school in an urban low-income area. I have been teaching there for four years. I am responsible for teaching approximately 90 students per day. Frederick Douglass Preparatory School was placed on, and remains on, the SURR list for low achievement on the New York State Math 8 Exam. SURR is an abbreviation for School Under Registration Review. If the student body does not show sufficient growth on the Math Eight Exam within a certain time frame, a number of things will happen, none of which are in FDPS' best interests.

It is my opinion that the only way students begin to value the learning of mathematics is if they have teachers who can motivate them to want to learn mathematics. Regardless of a student's academic mathematics history, the use of motivational techniques can drive a student to want to feel successful.

Having the ability to motivate others is a powerful tool. All leaders, great or otherwise, possess this quality. You can motivate people in both positive and negative directions. The focus of this research will be on what I can do to motivate my students to do their very best in mathematics while maintaining a positive attitude toward learning.

When students work toward the completion of a task, they should be encouraged and properly rewarded. Upon completion of a task, students should enjoy the fruits of their labor. When a student completes a task, or is working toward completion of task, he or she should feel a sense of satisfaction or pleasure by solving a problem correctly. For most, the completion of a task followed by praise and recognition is enough; others require extrinsic reward or incentives. As students seek rewards for hard work, they will be motivated to seek even higher learning and higher forms of praise. They will also begin to realize that incentives are used with the hope of increasing students' intrinsic motivation.

This research advances work in the teaching of middle school mathematics. It serves as a reminder to teachers that their efforts are not in vain. It motivates urban middle school mathematics teachers to not lose hope and to seek evolutionary teaching practices. It serves as motivation to all new teachers who intend to teach in an urban setting; the rewards are great teaching there. Teaching is one of the few professions where you learn about yourself and how to positively interact and influence others.

It is not easy for a teacher to motivate students that he or she perceives as not caring about their academic success. Students must learn that there is a reason to learn mathematics. Students must understand the purpose for the educational process. Teachers should understand the powerful influence they have on a community by teaching the young how to make themselves enjoy the positive affect of their hard work (Ecc. 2:24).

Chapter 1: Motivating the Math 8 student

Students should be given clear reasons for having to learn mathematics. If a student is not aware of sufficient reasons for studying mathematics, it will result in a lack of interest. Teachers must furnish and constantly remind and build on the reasons for studying mathematics. A teacher cannot assume that a child's parent or parents are providing adequate motivation. Quite the opposite, in some cases, parents perpetuate the rumor that mathematics is difficult. Parents' influence can sometimes, inadvertently negatively affect a student's academic achievement in mathematics.

It is the teacher's responsibility, and therefore should be his or her objective, to motivate students to value learning mathematics. School councilors, administrators, principals, vice-principals, and students all play a part in the motivation process. Leaving nothing to chance, the eighth grade math teacher must take the initiative to provide his or her students with meaningful reasons for seeking success in mathematics. A student must be taught that rewards are in store for those who show diligence, motivation, and perseverance in pursuit of an academic goal.

A very interesting and thought-provoking question that I asked my students in a survey was, "Why should you have to learn mathematics?" A resounding near sixty-two percent left the question blank or gave an incoherent response. Based on the results of this survey, it's obvious that the majority of my eight grade math students have not been furnished with sufficient reason to value the learning of mathematics. If students do not value the learning of mathematics, it is less likely

that they get any gratification or satisfaction from the completion of mathematical tasks.

Atkinson (1964) suggests that, “We like, want, or desire what is a personal gratification, a source of satisfaction or pleasure” (p. 5). That being said and understood, math eight students must feel a sense of satisfaction upon the completion of a meaningful task. For some students, praise and recognition from peers and teachers might be enough motivation. For others, their parents’ expectations and praise is enough motivation. There are some students who require extrinsic rewards and incentives from parents and teachers to begin to understand the importance of learning mathematics. These students need a feeling of gratification and a sense of pleasure upon completion of tasks. Others, which are not as far along in the understanding of the importance of mathematics, may require the implementation of a reward system. With consideration of students’ varying levels of motivation, a teacher should assume that all students need rewards for motivation. Teachers should have the objective in mind of weaning students away from rewards to the more effective motivational tool: incentives.

Research indicates that the use of rewards, such as money and other material benefits, can be used as motivators (Jung,1978). I have come up with the idea of having class currency. Money is often a reward in the real world for hard work. How better to reward students than to pay them for their efforts and have things they can buy that interest them for a certain amounts of class currency? The use of currency can be a working model of how mathematics is needed in the real world. With my

class currency, there will be discounts on certain items and varying sales tax rate. It will be a fun way for students to both understand the importance of being able to calculate total cost and the importance of being able to function mathematically in society.

It is important to note that motivation is not extrinsic, but intrinsic. Atkinson (1964) says, "The origin of our impulses to do this or that, whether called a want, a wish, a desire (or even a longing, yearning, harkening, or craving) are all more generally considered motives-that is, that within an individual rather than without which incites him to action" (p. 4). So, although money is an extrinsic reward, the actual reward is the earning of what is wanted, a reward for their efforts, something tangible. The ultimate goal of using rewards and incentives is reached when students become intrinsically motivated to learn mathematics.

I believe that a teacher's ultimate goal is to teach students to be intrinsically motivated. Beck (1978) says, "The term intrinsic motivation refers to factors that make certain activities rewarding in and of themselves" (p. 144). I agree with deCharms' opinion more. He wrote that there should be an interaction of intrinsic motivation and external rewards, not just one or the other. A teacher must be careful in issuing rewards. If a student begins to feel dependent on a reward being issued by someone else, namely the teacher, the activities necessary to get those rewards will be less intrinsically motivating (Beck, 1978). There are even arguments that rewards simply do not work (Beck, 1978). Beck (1978) says, "Incentives, like drives, are often said to energize behavior, but are described as "pulling" rather than "pushing."

” (p. 148). There is a strong suggestion that the anticipation of rewards or punishments does not influence our behavior, but become more and more ineffective as time passes.

As rewards are issued there becomes a shift in their worth. That is, student performance will begin to vary with the amount of class currency rewarded. In order for students to have the same amount of motivation they may begin to require more class currency to complete minimal tasks. Giving students the power to negotiation the worth of meaningful tasks will make the reward system less affective.

There was a study done on the effect of anticipated rewards. The result of the study was that performance varies with the amount of the reward (Black, 1969). In fact, there was an even more convincing study in which rats received 1,4,16, 64, or 256 small food pellets at the end of a straight runway. The more pellets received, the faster the animal ran. When shifted to a different number of pellets, their running speeds changed appropriately (Crespi, 1942). I am not likening my students to rats, rather using this as an example and keeping a watchful eye as I implement my reward system. Again, it is my intention to begin with a reward system and then wean them from rewards to incentives. The big difference between the two is that the class will know what the incentive prize will be and they will know that someone in the class will get the prize or prizes. The prizes need not be costly, but they do need to be useful to the student.

It would be a best case scenario to convince a student that what they are learning in math class was essential for their existence. How can a teacher convince a

student that the necessities to their existence are food, water, shelter, clothing, reproduction, and mathematics? To draw the relationship between mathematics and the first four things is certainly an over-exaggeration. The question is, "If a teacher can not convince a student that they need the information included in the math eight curriculums, what do you have left to gain their interest? It is better to consider the fact that mathematics relates to everything. It is the teacher responsibility to make those connections and use them in his or her classroom.

Barry and Wolf (1965) suggest that, "To live, to internalize culture, to perpetuate internalized learning, to express oneself within a culture, and to achieve positive experiences- these are the universal motivating forces" (p. 33). If we can agree that these are the things that motivate, we must consider what we as teachers can do to create an environment where all students will experience these five things in the classroom.

Obviously, students will live and therefore there is no need to focus our attention in that direction. It is interesting to note that students are motivated by internalized culture. There are certain things that become a large part in students' interaction. For instance, students in an urban setting embrace their cultural use of slang. Their slang is very much a part of their culture and affects how they interact socially. I have yet to hear two students converse at Frederick Douglass Preparatory School without the use of slang. What would motivate a student to speak without the use of slang amongst the majority? What would be a student's objective for speaking outside of the cultural norm of the building, or of the community? Certainly, slang is

vivid, and expressive. I'm actually quite impressed with some derivations of the English language embraced by urban middle school students. My argument is this, "Let slang be a part of class culture; Let your focus be on teaching and motivating students. A teacher must learn to direct his or her efforts appropriately to establish a culture in which students clearly understand that the objective is learning mathematics.

Students will strive to perpetuate their internalized learning of their culture (Barry & Wolf, 1965). If a teacher tries to rid the school of the slang used by students in conversation, they are indeed in for an uphill battle. I suggest that it is not worth the effort to attempt to rid the school of slang, but rather embrace it and decorate it with a little bit of proper English. With subtlety, a teacher can consciously affect the internalized learning of students. Teachers can subtly influence students to begin using proper English over time.

I firmly believe (and my survey of my eight grade students confirms my belief) that students like to learn and are motivated by success. Somewhere, all people learn or have the innate understanding that knowledge can be gained. Mathematics is no different. My survey indicated that overall, students enjoy learning new things, but they do not like it when things do not make sense. Teachers must strive to teach with clarity, making connections to students' prior learning. When this is done; it is easier for students to remember information and formulate reasons for learning. The drive to perpetuate learning or understanding is there as a motivating force.

All students want the freedom to express themselves within a culture and receive a positive experience as a result. It is the teacher's responsibility, when a student expresses him or herself appropriately in class, to provide the student with a pleasurable consequence. If a student answers a question correctly, that student's expression must be followed by a positive experience. It does not have to be a piece of candy, as extrinsic rewards do not work over the span of a school year. The teacher must keep in mind that his or her goal is to move from the use of rewards, to the use of incentives, to provoke intrinsic motivation. A teacher needs be observant of what type of consequence should follow a student's academic successes rather than consequences that follow disruptive behavior. If it is necessary for students to experience another sort of incentive other than a smile and praise from a teacher or other students, then a teacher should recognize that and furnish the incentive needed for that student or group of students.

All students should have the understanding that everything they say or do within the class will lead to their better understanding or their classmates' better understanding. A teacher should express to students that when they ask questions, they add to the learning and understanding of their peers. Students should be praised for asking questions and being attentive to the teacher's response.

It is the teacher's responsibility to come up with creative positive experiences for their students when they express themselves by communicating mathematically or using pro-social skills. A middle school mathematics teacher should not forget that one of the objectives of cooperative learning is for students to build social skills. A

math class setting should serve as a guide for the students' topics of discussion. More specifically, students are motivated by having the freedom to say what they want and have it be appreciated by others.

If a teacher can succeed in creating an environment where students can express themselves while perpetuating internalized learning and receive a positive experience during and as a result, then they have succeeded in creating an ideal learning environment (Barry & Wolf, 1965). In order to establish this ideal learning environment, a teacher must consider how his or her attitudes and perceptions are affected by motivation as well as the students'.

Chapter 2: How to elicit positive attitudes and perceptions toward teachers, students and between peers

Dimension 1 of Dimensions of Learning is rightly placed. Certainly, the attitudes and perceptions of students and teachers affect a classroom's climate and necessarily students' levels of success. It seems fitting, as a professional, to make certain that I am able to positively affect all of my students' attitudes and perceptions about mathematics and the educational process in general. As Marzano and Pickering (1997) record, "When our attitudes and perceptions are positive, learning is enhanced; when they are negative, learning suffers" (p. 13). Therefore, it is my intention to further my research by searching for ways to positively affect students' attitudes and perceptions toward mathematics.

All students should have positive attitudes and perceptions toward their teachers. The teacher should have a vast understanding of what students and teachers do that might affect students' levels of comfort. A teacher should reflect on mistakes he or she has made in the past when dealing with students and also learn from mistakes that other teachers have made when dealing with students. For example, yelling at students and belittling them does only one thing: destroy a classroom's climate and the relationships between students and teachers.

A teacher must be able to pick up on subtle cues of discomfort students give and skillfully alter what he or she is doing to allow that student to feel comfortable again. For example, suppose the teacher asks a student, "What is the answer to

question three on the board, Kelly?” Kelly looks up wide eyes and mildly panicked. The class, that was quietly awaiting Kelly’s response, now notices her face changing from white to red with embarrassment. Her classmates begin to laugh. The students near her begin to whisper the answer to her (possibly to turn the class’ attention away from her). Some students continue to snicker while others begin to engage in conversation. As the snickering dies down, the teacher repeats the question slower than the first time almost teasing Kelly, “What is the square root of sixteen? This is an easy question, Kelly. Maybe if you were paying attention instead of talking to Mary, you would know the answer.” The laughter has come to a complete standstill as all of the students realize that the teacher is not being very professional. Michael who is one of the “smarter” kids in class gets frustrated with either the teacher or Kelly and shouts out the answer from the back corner of the room.

The scenario above could be realistically continued spiraling further and further out of control. If you have had any experience as a middle school teacher, you are well aware of this situation to one degree or another. As terrible as it sounds, many teachers have unconsciously committed this climate-destroying act of belittling a student before his or her peers. The question from here: “What can be done to repair the relationship?”

First the teacher must feel sorry for what he or she did and reflect on the situation. A teacher should be aware of the fact that, in most cases, the student you are calling attention to in scenarios like this one is the student that disrupts the educational process nearly every day. He or she tends to be loud and confrontational

and doesn't appear to care how well they perform academically. A teacher must realize that relationships are repairable. With awareness, a teacher will realize a way in which the relationship can be built because of the interaction. Moved by his or her conscience, the teacher has a responsibility to find a way to interact positively with Kelly.

It is the teacher's responsibility to repair the relationship, because he or she failed in building a relationship in the first place. If the teacher had built a positive relationship, or even one of mutual respect, the incident may not have occurred. Even if it had, the teacher had an opportunity, during the moment of silence and before she sunk in her seat from embarrassment, to turn the classes' attention away from her. The teacher could have redirected the students' attention to another student by asking that student the same question. The teacher could have given Kelly the answer to the question and explained why it was the correct answer, then give a few more examples and allowed her an opportunity to answer a similar question instead. The teacher could have said something completely off topic to draw the students' attention away from Kelly and back to the teacher. The number of things a teacher could do in this situation to make a student feel comfortable and accepted is innumerable and is only limited by the teacher's creativity. A teacher should be motivated and enjoy this process of problem-solving. There is a real-world problem requiring a solution that will lead to a better relationship.

Unfortunately, when a student has been made to feel uncomfortable because of something the teacher did, it might take a while before the student regains the

comfort and trust of the teacher and have faith that the teacher will not belittle them before his or her peers again. Kelly was caught by surprise this time. Next time, she might sharply reply, “I don’t know”, in order to redirect the teacher’s and students’ attentions. This is the result of the teacher not dealing with the situation correctly the first time. Kelly has gone to the extreme of premeditating what she would do if the situation ever arises again. Certainly, after this event, Kelly’s attitude toward math class has been changed for the worse. It is the teacher’s responsibility to have ideas for redirecting students’ attention with the intent of eliciting positive attitudes and perceptions toward the teacher. The teacher should reflect on what happened and what he or she could have done instead to ensure that Kelly did not feel uncomfortable.

After making Kelly feel uncomfortable, what should the teacher do to build her comfort level again? The teacher could speak to her privately. The teacher could apologize, if he or she is truly sorry. The teacher could ask the student: “How should I have asked you the question? Okay, next time, I’ll try that.” A teacher should remain pleasant. If the student does not have any suggestions, then the teacher should offer a few. Come to a realistic agreement that works for both of you. Give her a new task that she will find pleasurable and meaningful. Change her seat in the class. Let her know that she will do a wonderful job in her new location in the class. Do whatever you must to build a positive relationship between you and the student.

The teacher’s demeanor should be in control, and calm, not angry. The teacher’s words should be meaningful, and heartfelt, perhaps even light in nature.

There is no textbook approach to dealing with 90 middle school children with varying personalities. A teacher should build relationships. As you know how to interact with friends and family, you should also learn how to interact with each student according to their individualized personalities. I suggest you try to interact with all students as you interact with the students you like the most. For every situation, and with every student, there is a different way you might need to present yourself. Either way, the mood should be light and the teacher's concern for the student's feelings should be heartfelt. A teacher should never forget that one of his or her responsibilities is to maintain an emotionally safe environment in which all children can learn.

It is the teacher's responsibility to elicit positive attitudes and perceptions from learners (Marzano & Pickering, 1997). If a student has a negative attitude toward a teacher, in most cases, it is the result of something the teacher did or said to offend the student or something another teacher did or said earlier to that same student. When a student dislikes a teacher for one reason or another, the teacher should reflect on their relationship. Somehow that teacher must convince the students that he or she cares about their academic success and level of comfort in the classroom. It is the teacher's responsibility to skillfully and purposely positively influence students' attitudes and perceptions toward the educational process.

The teacher must be aware that students' attitudes and perceptions have an affect on learning. When students do not feel accepted they feel uncomfortable, distracted, or depressed (Marzano & Pickering, 1997). Marzano and Pickering (1997)

report, “Students who feel accepted usually feel better about themselves and school, work harder, and learn better” (p16). This further supports the fact that a very large, and often neglected, responsibility of a middle school math teacher is to make certain that all students feel comfortable in class. Part of Standard Three of the New York State Standard for Mathematics states that, “Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically.” In order for students to communicate and work cooperatively, all students must feel accepted by their teacher and peers.

Marzano and Pickering (1997) offer the following 15 strategies to use to help students enhance their attitudes and perceptions and to help students develop their own strategies for enhancing attitudes and perceptions. (It would be wise for the teacher to consider how these 15 steps can enhance his or her attitudes and perceptions toward students as well):

1. Help students understand that attitudes and perceptions related to classroom climate influence learning.
2. Establish a relationship with each student in the class.
3. Monitor and attend to your own attitudes.
4. Engage in equitable and positive classroom behavior.
5. Recognize and provide for students’ individual differences.
6. Respond positively to students’ incorrect responses or lack of responses.

7. Vary the positive reinforcement offered when students give the correct responses.
8. Structure opportunities for students to work with peers.
9. Provide opportunities for students to get to know and accept each other.
10. Help students develop their ability to use their own strategies for gaining acceptance from their teachers and peers.
11. Frequently and systematically use activities that involve physical movement.
12. Introduce the concept of “bracketing.”
13. Establish and communicate classroom rules and procedures.
14. Be aware of malicious teasing or threats inside or outside of the classroom, and take steps to stop such behavior.
15. Have students identify their own standards for comfort and order.

Chapter Three: Attribution theory and the Math 8 classroom

Teachers must realize that students, consciously or unconsciously, formulate reasons for lack of success, not doing their homework, not completing tasks, being unprepared, and not doing well on tests. Students can even create reasons why they don't want to work in cooperative groups. Attribution theory is a worthy field of study. It sheds light on why students consciously or unconsciously find reasons for their actions and lack of academic success. For the purpose of this research, attribution theory is concerned with how and why students explain events using commonsense explanations (Hewstone, 1983). A teacher must realize that just because middle school students may not be able to report (or are not willing to report) attributional activity does not necessarily mean that it is not occurring (Hewstone, 1983).

When students get bad grades, they reason within themselves for a reasonable cause. Some students find reasons for lack of success within themselves, while others find reason outside themselves. We refer to the former as optimistic or efficacious and to the latter as pessimistic or helpless (Peterson, Seligman, & Vaillant, 1988).

For example, as students wait for a teacher to grade and return a test they anticipate a certain result. If a student receives a higher score than anticipated, he or she is happy and attributes her good grade to the fact that she studied hard last night. When students do poorly on tests, they are more likely to laugh, curse, rip up the

paper, and mostly likely make light of the test grade before their peers. Why do they do this when they receive a poor test grade? Who or what do they blame as the cause of their poor grade? Who does the teacher blame for the students' poor grades? Who does the administration blame for students' poor grades? The student and the teacher may consciously or unconsciously convince themselves of the cause and whether the cause is due to an internal cause or an external cause. Hewstone says, "Internal causes are factors within the person (e.g. effort, ability and intention), while external factors lie outside the person (e.g. the difficulty of the task, and luck)" (p. 4).

When a student fails a test, the teacher should make efforts to find the reason why he or she failed. For example, a teacher could ask Talia, "Why did you get a 33 percent?," while considering possible factors within him or herself as to why she failed the test. If she says, "I just can't do it.," then the teacher should realize that her self-esteem has fallen and her attitude and perception of the study of mathematics has been diminished (Graham & Folkes, 1990).

If she says, "My mom isn't good at math either." She has indicated a stable cause to her lack of success in mathematics. When this happens, deficits are long-lasting (Graham & Folkes, 1990). A teacher should try to teach a student that his or her parents' success or failure in mathematics has little to no affect on his or her ability to do well in math.

If Talia's response to why she did poorly on the test was, "I did poorly because I'm African-American, none of us are good at math," then she has offered an explanation in terms of global factors. When this happens, a student's perceived

helplessness is pervasive (Graham & Folkes, 1990). Teachers should also consider that students have a habitual tendency to explain events in one way or another (Graham & Folkes, 1990). Suppose Talia's explanation for doing poorly on test is always, "You don't explain things enough!" The teacher should realize that it is due to her explanatory style, her habitual tendency to explain her poor achievement on tests in a characteristic way (Graham & Folkes, 1990).

Considering the complexity of reasoning within one's self to formulate the cause of successes and failures, a teacher should ask a student why he or she performed poorly: The teacher should figure out whether he or she is using internal, stable, or global causes as explanations. The teacher can then direct his or her efforts accordingly based on the type of reasons the student attributes to his or her lack of success.

For example, suppose Shakiera sincerely states that she likes Talia. Yet, Shakiera is observed picking on her daily. She annoys, teases, and taunts Talia, making every day a miserable experience for her. Shakiera even refuses to work in the same group with her. She is heard by the teacher saying, "I am not working with her! I don't care if I get a zero. I'll work by myself or work with another group." Shakiera shows no reserve or remorse in making it clear that she refuses to work with Talia.

Clearly, Shakiera's actions and words indicate that she does not like Talia, spite the fact that she told the teacher that she did. Teachers must realize that behavior is more a function of social norms and pressures than internal states (Ajzen

& Fishbein, 1983). Shakiera could have realized that what she had done was wrong, but she may have perceived it as amusing or accepted by her peers. Shakiera could have observed someone she views as “cool” picking on Talia and decided to join in the teasing.

The teacher should be motivated to find the reason why Shakiera picks on Talia. Some behaviors are consciously regulated while others are not. The teacher’s task is to decide which effects of the observed action, if any, were intended by the student (Hewstone, 1983).

Sometimes teachers make wrong assumptions for the reason for students’ attitudes and perceptions. If a teacher views Shakiera as mean for no just cause, he or she is guilty of being presumptuous. To infer that any of the effects were intended, the perceiver must believe that the actor ‘knew’ the consequences of his or her action (Hewstone, 1983). Reflecting longer, the teacher should conclude that very few students would intentionally cause great discomfort to a classmate.

A teacher has the responsibility of finding the reason why Shakiera picks on Talia. As the teacher asks Shakiera questions about why she picks on Talia, he or she should be observant of the words and the way Shakiera speaks, paying close attention to her body language (fidgeting, gestures, etc.), and perceived emotions. The teacher can get far more information than verbal response while asking questions. A teacher should attempt to judge the sincerity of a student’s verbal response to meaningful questions pertaining to peer-relationships.

A teacher should enjoy the problem solving process as they attempt to find the reason for the many decisions that students make academically and otherwise. The teacher must take account of the 'configuration' of factors that are plausible causes for the observed effect (Hewstone, 1983). Shakiera may have no idea of Talia's feelings. A teacher should constantly work to strengthen his or her relationship with all students so that students will be willing to reason about their actions.

Most teachers generate a cause for a student's negative behavior. The cause constructed by the teacher is either true or false. Either way, it affect their perception of why students succeed or fail at tasks as well as how they interact with particular students. If the cause is incorrect, then the teacher may take the wrong approach to positively affecting students' attitudes and perceptions.

Attribution theory is a useful tool for teachers to consider. When teachers, attempt to find explanations for an observed behavior or to draw inferences from it, they may be viewed as searching for hypotheses that could provide answers to these questions. One important issue that confronts attribution theory concerns the factors that influence the selection of these hypotheses (Jaspars, Fincham & Hewstone, 1983). Clearly, people cannot formulate hypotheses about causal or dispositional properties that are not part of their cognitive repertoires (Tversky & Kahneman, 1973). A teacher must build his or her cognitive repertoires in order to not rule out any possible cause of students' negative attitudes and perceptions toward mathematics, peers, and teachers.

Teachers should always remember that nobody is perfect. Middle school children do not come to us with great social skills. We are there to teach them how to work together toward the completion of meaningful tasks. Students and teachers should learn from their mistakes by reflecting and possibly feeling remorse for their inefficiencies. We have a responsibility to our students to assure a safe environment in which to learn. Part of creating such an environment must include consideration of how to motivate and positively affect students' attitudes and perceptions toward mathematics and each other.

Lastly, by understanding what students attribute to their successes and failures, teachers can rightly direct their efforts in helping students perform mathematically. A teacher should be driven to have a positive relationship with all of his or her students. All mathematics teachers should be motivated to, perhaps subtly, improve all of their students' characters, social skills, and their learning of mathematics.

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Discussion, Summary, Reflections

This research has helped me understand possible reasons why some students don't succeed in mathematics. Some students have negative attitudes and perceptions toward mathematics, while others lack motivation to succeed academically for varying reasons. It is my objective to teach them why mathematics is a necessary topic of study. As I teach using real-world problems and illustrations, students will begin to realize the necessity of mathematics and, as a result, improve their mathematical performance.

A teacher can use proven techniques to eliciting positive attitudes and perceptions. Teachers should motivate their students to succeed academically. Through the use of various proven techniques, students' attitudes and perceptions toward mathematics and the educational process can be changed for the better.

I learned that a teacher should communicate with students considering their perceived reason for failure. Some students are more difficult to motivate than others. A teacher's pleasure should be enjoying the challenge of trying to find a way to motivate all children to enjoy the result of their hard work. The study of attribution theory and the use of rewards and incentives can be useful when trying to elicit positive attitudes and perceptions from students. Teaching in an urban setting presents many challenges, but it is the challenge that motivates and makes it an exciting place to teach. It will take years to perfect the art of teaching mathematics. I am also motivated by the idea of seeing myself improve as an educator. My research

has taught me to reflect on a student's perceived reason for failure. I look forward to implementing what I have learned as a result of this research.

I learned how important it is to truly care for the well-being of each student. A teacher should make efforts to form positive relationships with all of his or her students. A teacher cannot show favoritism and have high expectations of some students. Perseverance is needed to reach all students. Some students have few interests. It is the teacher's responsibility to help students find interests and activities that will spark their interest to do well academically.

I enjoyed the research and learned an immense amount of information as a result. As my research is coming to a close, I realize the importance of intrinsic motivation. Students should begin to understand that the obstacles and difficulties that come along with the study of mathematics are a necessary and meaningful part of the learning process. It leads to a feeling or sense of satisfaction when meaningful tasks are completed.

Without the difficulties and hours of hard work needed to complete this research, it would not have been a meaningful culminating activity. I believe in high standards in mathematics for that reason. Students can be built up mathematically with the use of rewards, incentives, and purposive interaction with the hope of eliciting positive attitudes and perceptions toward math. I believe students will be intrinsically motivated by challenging math problems in this unit and many units to come.

The first lesson plan includes some of the things that teachers should think about while preparing lesson plans. It will include a reflection on teacher and student attitudes and perceptions. It is interesting and useful to consider students attitudes and perceptions while creating lesson plans. A teacher should continue to work toward being a better teacher and making mathematics easier for students to understand.

Volume and Surface Area Unit Pacing Chart

<p>Math Minute #1</p> <p>Problem of the Week #1</p> <p>Lesson #1</p>	<p>Math Minute 2</p> <p>Lesson #2</p>	<p>Math Minute 3</p> <p>Lesson #3</p>	<p>Math Minute 4</p> <p>Lesson #4</p>	<p>Math Minute 5</p> <p>Quiz1</p> <p>Lesson #5</p>
<p>MM6</p> <p>Problem of the week #2</p> <p>Lesson #6</p>	<p>MM7</p> <p>Quiz 2</p> <p>Lesson #7</p>	<p>MM8</p> <p>Lesson #8</p>	<p>MM9</p> <p>Lesson #9</p>	<p>MM10</p> <p>Quiz 3</p> <p>Lesson #10</p>
<p>MM11</p> <p>Problem of the week #3</p> <p>Lesson #11</p>	<p>MM12</p> <p>Lesson #12</p>	<p>MM13</p> <p>Quiz #4</p> <p>Lesson #13</p>	<p>MM14</p> <p>Lesson #14</p>	<p>MM15</p> <p>Quiz #5</p> <p>Lesson #15</p>
<p>MM16</p> <p>Problem of the week #4</p> <p>Lesson #16</p>	<p>MM17</p> <p>Quiz #6</p> <p>Review for Unit Test #1</p>	<p>MM18</p> <p>Review of Unit Test #1</p>	<p>MM19</p> <p>Unit test #1</p>	

The Rochester Instructional Framework

Lesson Plan 1

Lesson Topic:

- The properties of unit squares and squares
- Their area, their perimeter
- Their importance

NYS Learning Standard

Standard 3

Students will gain mathematical confidence with this simple introductory concept.

Students will understand that area is simply the counting of unit squares in a particular area. Students will gain confidence by working in cooperative groups.

Standard 4

Students will understand the purpose of the unit square, a necessary concept used throughout the sciences to measure area. Students will learn that the finding of the area of things is found in many places.

Standard 5

Students will construct polygons from inch squares, understand, and be able to find the area of those newly formed polygons. Students will design and construct a polygon from inch cubes and find its area and perimeter. Creativity will be rewarded.

Key Ideas

Modeling/Multiple Representation

Students are reminded that the unit square is the fundamental building block for finding the area of anything. They learn of the notation used for area and its meaning and reason for being.

Measurement

Students learn of the unit square, in particular the cm square and inch square, a fundamental building block for finding the area of anything. Students will measure using both metric and English measure.

LESSON PREPERATION

Objective: Students will learn or recall...

- a. the properties of a square
 - sides, edges, line segments
 - vertices
 - 4 sided regular polygon

- b. the unit square (a special square)
 - its properties
 - its area its perimeter

c. the area of a square

- tile a square with unit squares
- the fast way to count how many unit squares fit in a square ($A = s^2$)

d. the perimeter of a square

- the sum of the outer edges of a unit square
- the distance around the square

Essential Question: What is a unit square?

Materials:

- inch squares
- transparency with a unit square on it
- a worksheet
- a transparency of the worksheet

WORKSHOP

Bridge: Warm-up

- Have inch squares scattered all over the floor.
- Everyone pick up an inch square from the floor
- Have you seen one of these before?
- Where?
- The teacher should show great enthusiasm, make squares sound fascinating, if they weren't fascinating they wouldn't be scattered around the room, nor would they be studied throughout higher level mathematics.

- Put up an inch-square transparency and have students trace their inch-square in their notebook
- Why do you think it's called an inch-square? This question requires higher order thinking. They cannot respond with a one word response. They will improve their ability and confidence in communicating mathematically.
- Note all responses, even if it means elaborating on an incoherent response. Make sense of it. The only one in the class that should know that the student is way off base is you and that student. The student knows when their response is wrong. It is a teachable moment to notice when a student is completely off base. Discretion is needed when addressing a student's incorrect response before his or her peers. Don't praise yourself for stumping the smart kid. Their reward is being the one that's the "smartest". Every student has the right to know that everything they say adds to the class discussion.
- Introduce technical terms for what students offered during the word splash if any are missing. The ones that remember those technical terms should be praised the most. Often, a right response seems untimely and a teacher looks at the student as though they understood something too early in their lives. I call that the, "would you wait! I didn't call on you" response. A teacher should be mindful not to do this.

Mini-lesson 1: teacher directed

How big is a dollar bill?

- In our class we will have dollar bills with various faces on them. The first dollar bill will have my face on it. Humor is a good thing to use in the classroom with eighth graders.
- Distribute fake dollar bills with my picture on them. Inform them that if the bill is defaced it is null and void and cannot be used for currency in this class. Those dollar bills will be the reward system of this class. When students work well they will get “fake dollar bills”. Academic success and doing good things in class will be rewarded with class currency.
- Let’s judge how big it is by how many of our inch-squares fit in it.
- Have students tile their fake dollar bill and record responses. Thereafter, record students’ estimates of the area of the dollar bill on the transparency. Students will record the collected data from the various groups in their notebooks.

Note in passing:

Be careful not to misguide students’ concerns. For example: when passing out inch-squares, don’t stress how much time or effort went into making the squares. Few students will care. Instead, tell them you made them for them so that they will better understand the lesson. Recall, as a teacher, we won’t necessarily be rewarded for all of

our efforts. Everything the teacher does to help a student should be recognized by the teacher, not necessarily by the one being helped, the other students, or the house administrator. It is difficult to perform at a high level without having praise from others. How much should we praise the student that is at the top of his or her class? It would be an educational tragedy for a child that tries hard to feel as though his or her efforts are in vain. At the same time, we should understand that our efforts may seem unrecognized. Our motivation shouldn't be recognition, but in seeing our kids succeed and enjoying success.

Many good teachers feel unappreciated by administration and the public at large. It doesn't take a great deal of effort to pay a compliment where a compliment is due. As the teacher should motivate his students, a house administrator should motivate his or her teachers. They are the few people that should understand our efforts. It would be an unfortunate situation for an administrator not to encourage or praise his or her teachers. The good news is; a good teacher can subtly model how affective praise is beneficial before his or her administrator. A teacher should compliment his or her administrator when a job is well done. A teacher, through modeling, can change an environment. Teaching is truly an art form and an instrument for change.

We must understand that our job is never done. Our job comes home with us; it even pervades our thoughts every now and then. The question is: what kind of thoughts most often come to mind? To complain internally is vanity. Truly, it is better to spend our time learning. Aren't all of our goals to be life long learners?

Work Time: Practice

In groups: Worksheet on unit square properties

Mini-lesson 2: teacher directed

To regain students' attention after having them work in groups can become a tedious task. It can have you standing before the class frustrated and looking out of control and angry. A failed signal for attention isn't a matter of life and death. Ask for their attention, and wait. Don't get angry. Act as if you are in control. Stand before the class, look side to side, make eye contact, smile, and continue with your signal for attention. There are usually enough allies in class that will help with this process. They are the ones that, untrained, yell across the room, "Would you guys shut up? He's waiting for you!" Here too is a teachable moment. It is a good idea to approach that student because apparently they have the comfort and the influence on other students to perhaps help you regain the other students' attention. Train that student to use their influence on others in a quieter way. Letting them know that you appreciate their efforts rather than telling them, "You're not helping! You're adding to the noise."

Teacher question:

How do you construct a polygon from inch-squares?

- Demonstrate how to make a polygon from 4 unit-squares (must connect edge to edge perfectly) on overhead projector
- Show them some shapes that are not polygons even though all edges are touching edge to edge

- Demonstrate how to find the area and the perimeter of various polygons constructed from inch-squares on the overhead projector

Work time: Practice

- Students continue to work in groups creating polygons by putting their inch-squares together. After that, they will find their polygon's area and perimeter. I will praise, answer, and ask questions while they work in groups. I'll look fascinated, interested, happy, proud, etc. Seemingly, teachers aren't allowed "bad days".
- Have students join two groups and form a big polygon with various color inch-squares. Building relationships between students in the class is an often overlooked responsibility of the teacher. Many students come to class shy, discouraged, uninterested, and lacking good social skills. These students sometimes feel unaccepted by peers and teacher. It is the teacher's responsibility to help those student feel accepted by his or her peers. A teacher should also make sure that they are making efforts to build their relationship with those students. Some good ideas include:

If you are having difficulty remembering particular students' names you should talk to them often and get close enough to them that you can see their papers. You should be circulating around the room anyway. Perhaps it makes a student feel

unimportant if you don't remember his or her name while you remember everyone else's name.

Make the sharp students feel sharper, and the duller students feel sharp. Even now, I have a student that is obviously smarter than the other students in my class and I find myself almost annoyed with his "know it all" attitude. I never liked "know it alls" when I was in school, even while in college. I now realize, through this research, it is my responsibility to encourage that student and help be confident without being cocky. I have to let him know that I value his input. I should never be annoyed by an overachiever's ambitions. I'm happy to say that, after reflecting on this issue, I appreciate their enthusiasm and I am apologetic for not encouraging them as much as I should have in the past.

It is my responsibility to guide all students into a leadership position in the classroom. Everyone's strengths and weaknesses play a part in the cooperative classroom. If you don't use the "smart ones" correctly you chance losing their interest. A fast learner is often bored or anxious to share his or her answer. It is important to give each group such a person. He or she will be the "smartest" in his or her group and get to share with others their level of understanding. It is important that you teach him or her how to be helpful. Efforts should be made early in the year to pinpoint such students. A teacher should train their overachiever into a leadership role.

Some of the students who are disruptive can be useful as well. With a little help and positive feedback, it's possible to get those students to become group leaders or facilitators. It is good to tell him or her, "You would make a great group leader! Do you

notice how other students respect you?" Stroke their ego. Let them know that you see how much influence they have on other students' behavior.

Ask the popular kid, "How do you think Tamika feels when she sits all alone in the back of the room by herself? She doesn't talk to anyone and no one makes efforts to talk to her. Wouldn't you like to help her feel more comfortable in class? Perhaps, we can have her join your group and you can help her feel more welcome. She's really a nice person." Teachers have power to influence, as do students. Teachers should influence students to be a positive influence rather than a negative influence on others.

Lastly, praise the students for their efforts and the fact that they worked wonderfully together. Don't belittle the importance of being able to work well with others. Let the students know when they are doing good things, things that will lead to academic success and educational process. Don't act as though you had control over the fact that they worked well together. Allow the students to have ownership of the fact that they have the power to do well or poorly. Reward those that choose to do a wonderful job. Kids in urban settings need our encouragement. Our encouragement needs to be meaningful and heartfelt. I can honestly say that I love all of the kids I have had the privilege of meeting. I love their individual personalities. I have learned to appreciate the fact that no two kids have the same personality. I am also apologetic toward those that I met early in my career. I'm much better now than I was four years ago, and I'm still learning and improving upon my practice.

- During the course of their group work the larger group formed will find the area and perimeter of their new polygon, decorate it nicely and choose a good place to put it in the class to show off their work.

Summary

Have groups present and put their poster up on the wall. Smile; be proud of their efforts and the other students' attentiveness. Make comments on how wonderfully they listen. Encourage them to ask questions. Teach them how to offer suggestions, how to praise others' efforts, how to enjoy working together. Do not show favoritism between students. Lack of equality in treatment will destroy a classroom's climate.

LEARNING EXTENTIONS

Homework:

Homework gives students an opportunity to practice independently the concepts from the day's lesson. You can also extend a concept, although not too far, using homework. A teacher must be careful to make sure that they aren't assigning homework that is too difficult or too easy. Homework in my opinion is the hardest thing to come up with. There shouldn't be too many questions, nor too few. The questions must reflect the expectations of the NYS Standards. Class tests should be reflective of the Math 8 Exam, the quizzes should be reflective of the tests, the homework should be reflective of the quizzes, the quizzes should be reflective of the homework, and the homework should be reflective of the class work and discussion.

The apparent difficulty is the retention of things taught last week, or three weeks ago. All previous concepts should show up in the present lessons, whether as part of a warm up or a multi-level problems, or homework assignment. Percents work well with a variety of other concepts. To help students remember, the teacher must make it a point to

review what they have already taught. Remind them often, teach to a higher dimension of learning, intertwine percents and area, percents and volume, etc. Any connection you can make between what you have taught and what you are teacher is an opportunity for review and an opportunity to teach them to the highest dimension of learning, to help them achieve a habit of mind.

Give the students homework 1 to begin in class. Stress the fact that homework is a simple name for independent practice.

Name _____

Homebase _____

Date _____

Lesson 1 Group Activity

Part I

1. A unit square has _____ sides.
2. A unit square has _____ edges.
3. An inch square has an area of _____ inches².
4. An inch square has a perimeter of _____ inches.

Part II

In your groups, join your inch-squares to form a new polygon. You must join them edge to edge perfectly. Glue your group polygon to a piece of colored construction paper to be placed on the wall for decoration.

5. What is the area of your group's polygon? _____ inches².
6. What is the perimeter of your group's polygon? _____ inches.

Name _____

Homebase _____

Date _____

Lesson 1 Group Activity 2

Steps to today's lab

1. Tape the inch-squares on the sides of an inch-cube.
2. How many inch- squares are needed to cover an inch cube?

Answer _____

Name _____

Homebase _____

Date _____

Lesson 1 Group Activity 2

Steps to today's lab

3. Tape the inch-squares on the sides of an inch-cube.
4. How many inch- squares are needed to cover an inch cube?

Answer _____

Name _____

Homebase _____

Date _____

Lesson 1 Group Activity 3

Steps to today's lab

1. Chose a rectangular prism to cover with inch-squares.
2. Tile the surface of your group's rectangular prism completely.
3. How many inch- squares are needed to tile your rectangular prism completely?

Answer _____

Name _____

Homebase _____

Date _____

Lesson 1 Group Activity 3

Steps to today's lab

1. Chose a rectangular prism to cover with inch-squares.
2. Tile the surface of your group's rectangular prism completely.
3. How many inch- squares are needed to tile your rectangular prism completely?

Answer _____

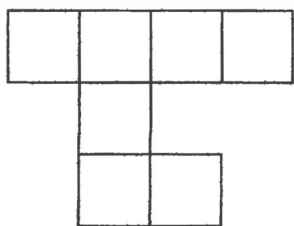
Name _____

Homebase _____

Date _____

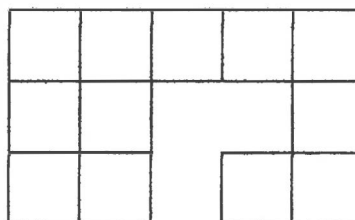
Homework 1

Directions: Find the area and perimeter of the following rectangular prisms made of cm cubes.



Area = _____ cm^2

Perimeter = _____ cm



Area = _____ cm^2

Perimeter = _____ cm

Create your own polygon by cutting out squares from inch-grid paper and gluing them in the space below. Find your polygon's area and perimeter.

Area = _____ in^2

Perimeter = _____ inches

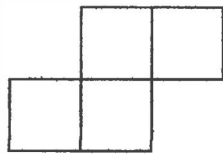
Name _____

Homebase _____

Date _____

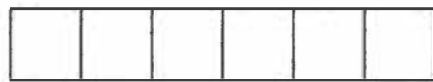
Homework 1

Directions: Find the area and perimeter of the following polygons constructed of centimeter squares, a fundamental unit of measure.



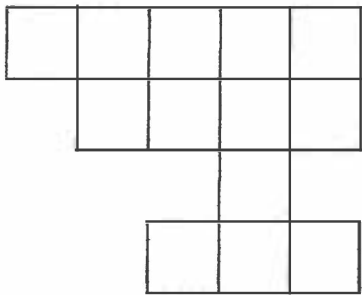
Area = _____ cm^2

Perimeter = _____ cm



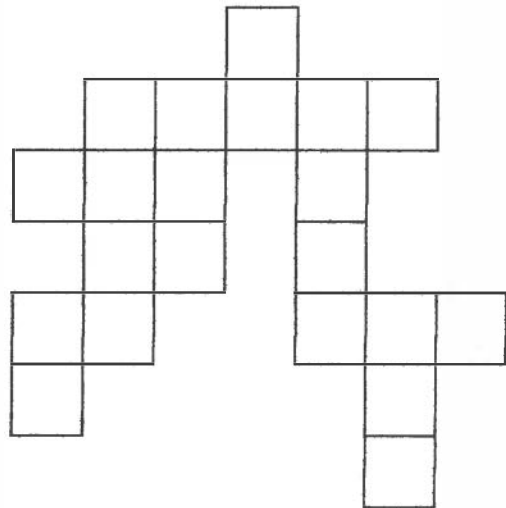
Area = _____ cm^2

Perimeter = _____ cm



Area = _____

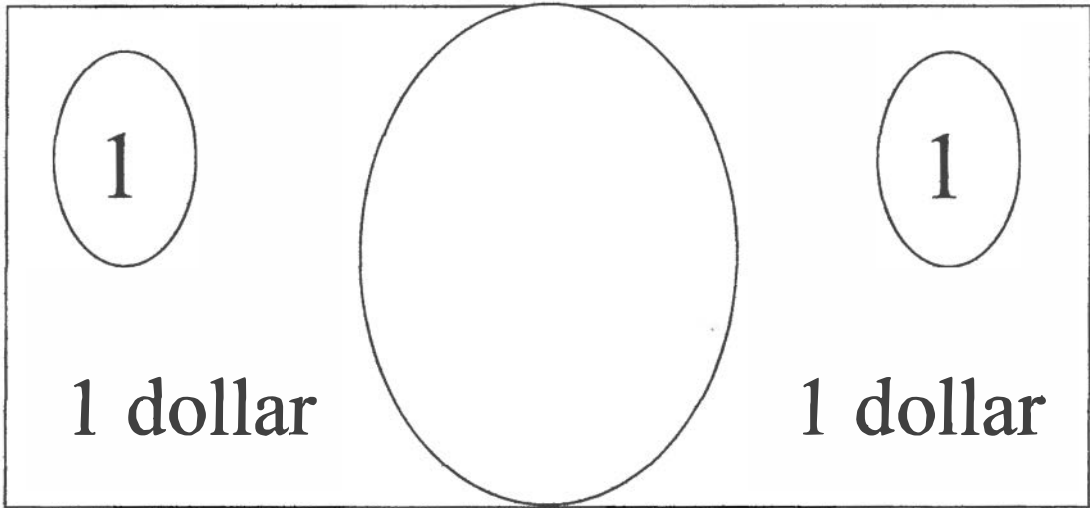
Perimeter = _____



Area = _____

Perimeter = _____

Interesting to note, these are all polygons. Although some are funny looking, they're still polygons.



You're doing great!

The Rochester Instructional Framework

Lesson Plan 2

Lesson Topic:

The rectangle and its properties

NYS Learning Standard

Standard 3

Students will work together to find the area and perimeter of various rectangles. Real world examples will be used in this lesson. Estimation will be used by cutting a rectangle into unit-squares and counting the number of unit-squares.

Standard 4

Observe and describe relationships between counting unit-squares and the area of a particular solid. Stress the fact that the use of area is used throughout the sciences.

Standard 5

Students will use rulers to cut an area into unit squares to find its area.

Key Idea

Measurement:

Students further their understanding of the unit-square as the fundamental building block for finding the area of things. This lesson furthers the students' measuring skills and the understanding that any area can be cut into or tiled with unit-squares and that is what area consists of. The use of formulas will be understood as a faster way to find area. Students will understand that the formula is a systematic method of counting the number of unit squares a shape entails.

LESSON PREPERATION

Objective:

- Students will learn or remember what a rectangle looks like
- Students will learn the properties of rectangles
- Students will learn how to find their areas by drawing lines creating unit squares within the rectangle
- Students will learn how to find its perimeter by counting edge lengths about its perimeter

Essential Question:

How do you find the area and perimeter of a rectangle by tiling?

Materials:

- Inch grid paper
- Scissors

- Glue
- Ruler
- Construction paper
- Markers
- Overhead transparency of a clear rectangle
- Colored transparency inch square tiles

WORKSHOP

Bridge: Warm-up

- Put up a transparency of a football field
- Ask students what it is, its shape. Are you sure? How do you know?
- Word splash on the football fields qualities
- Give specific properties of the rectangle if they have not been offered by the students
- Praise the use of proper vocabulary and use of good reasoning
 - consists of 4 edges
 - it's a polygon
 - 4 right angles
- IT HAS AN AREA AND IT HAS A PERIMETER
- What unit of measure should we use to find the area and perimeter of a football field?

Mini-lesson: teacher directed

- Introduce simpler problem with the same concept we will return to finding the area of a football field later.
- How do we find the area of this piece of paper? (Hold up a piece of paper).
- Teach them how to tile rectangles to find their area and perimeter (done on a transparency using the cm side of the ruler and a marker)

Work time:

Students work cooperatively tiling rectangles to find their area and perimeter. Each group will receive a different shaped rectangle to tile in order to find its area and perimeter. Estimation may be required.

Groups that finish early can color their tiled rectangle.

Two groups combine to create a polygon by connecting their tiled rectangle with another group's tiled rectangle. They will also have to find the area and perimeter of the polygon formed when they joined the rectangles together.

Summary:

The joined groups will present their polygon, its area, and its perimeter. If time permits, prior to their presentation, they will get the opportunity to decorate their polygon.

LEARNING EXTENTIONS

Assessments:

- good questioning techniques
- Analyze responses, guide responses, encourage
- Facilitate group discussions
- Analyze group discussions
- Grade class work and homework

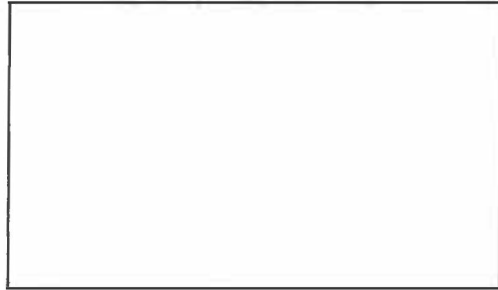
Homework:

Give the students another rectangle to find the area and perimeter of by cutting its area into inch squares.

Lesson 2 Transparency

Rectangle

Transparency for Lesson 2



The area of the rectangle is approximately
_____ cm^2

The perimeter of the rectangle is approximately
_____ cm

Name _____

Homebase _____

Date _____

Lesson 2 Group Worksheet

1. Estimate the area and perimeter of the following 10,000 yen bill by tiling its surface into inch squares. You must show your work.



Area \approx _____ cm^2

Perimeter \approx _____ cm

- a. How did you estimate its area?

- b. How did you estimate its area?

2. Estimate the area and perimeter of the following rectangle by tiling its surface into cm squares.



Area \approx _____ in²

Perimeter \approx _____ in

- a. How did you estimate its area?

- b. How did you estimate its area?

Name _____

Homebase _____

Date _____

Homework 2

Lesson 2 Homework

1. Estimate the area and perimeter of the currency of Central Africa by cutting it into inch squares.



Area \approx _____ in²
Perimeter \approx _____ in

Extra credit:

Find out how much Central Africa's currency is worth in American currency.

Answer:

2. Estimate the area of the currency of Afghanistan by cutting it into centimeter squares.



Area \approx _____ cm
Perimeter \approx _____ cm²

Extra Credit: For class currency:

Find out how much Afghanistan's currency is worth in American currency.

Answer:

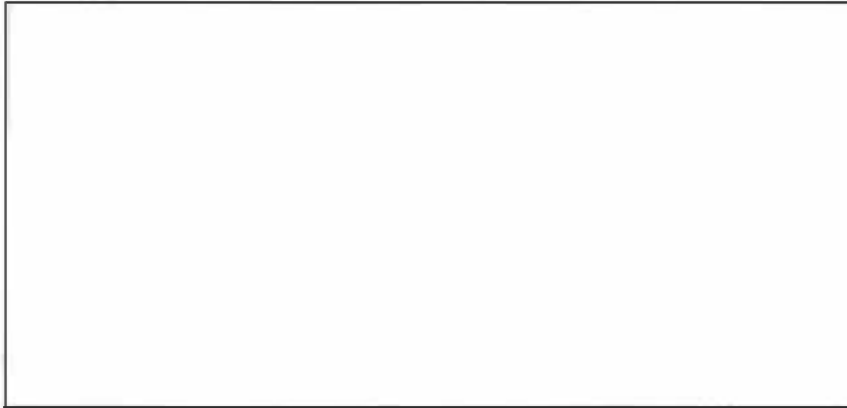
Name _____

Homebase _____

Date _____

Homework for lesson 2

1. Find the area and perimeter of the following rectangle by tiling its surface into inch squares. You must show your work.



Area = _____ in²

Perimeter = _____ in

2. Find the area and perimeter of the following rectangle by tiling its surface into cm squares.



Area = _____ cm²

Perimeter = _____ cm

The Rochester Instructional Framework

Lesson Plan 3

Lesson Topic:

Finding the area and perimeter of a rectangle; $A = lw$.

NYS Learning Standard

Standard 1

Students will use mathematical analysis to discover the quick way to find the area of a rectangle.

Standard 3

Students will understand the formula for finding the area of a rectangle and why it works. They will understand it as a quick way to count unit-squares. Students will gain confidence in communicating mathematically and reasoning mathematically as they work in groups on a common task. Real world examples and problems will be included.

Standard 4

Students will apply the formula for finding the area of a rectangle and solve problems pertaining to physical settings. They will understand the historical development of the concept of area.

Standard 5

Students will use what they have learned about how to find the area of a rectangle to construct irregular polygons from rectangles and find the new polygons area and perimeter.

Operations:

Students learn that the area of a rectangle can be found quicker by multiplying its two dimensions.

Modeling/Multiple Representation:

Area = Length x width, $A = L \times W$, $A = lw$, $A = L \cdot W$, $A = L(W)$

Measurement:

Students measure area by use of the formula, Area = length x width

LESSON PREPERATION

Objective:

- Students will learn how to find the area and perimeter of squares and rectangle with given dimensions

Essential Question:

What is the fast way for finding the area and perimeter of a square or rectangle?

Materials:

- Rulers
- Worksheet
- Calculators

WORKSHOP

Bridge: Warm-up

Introduce flat patterns of inch-cubes to the kids. Show them that it is simply an inch-cube unfolded. Find the area and perimeter of the irregular polygon. I will formally introduce the inch-cube as one of the fundamental units for measuring volume later.

Mini-lesson: teacher directed

Demonstrate how to find the area and perimeter of a rectangle by measuring its length and its width and then multiplying them.

Area = number of unit squares inside the rectangle = Length * Width

Perimeter = the sum of the lengths of the 4 sides of the rectangle

Work time:

In groups, give the students pre-cut rectangles. Have them measure and record the dimensions inside the rectangle. Finally, have them record the area and perimeter inside of their rectangle. When they are done, have them join their rectangles with

another group's rectangle and find the area of their new polygon. They may decorate their polygon if they finish early enough.

Summary

Have students come up with no more than five sentences in a group on how they would describe to another student how to find the area of a rectangle the fastest way possible and why it can be done in that way. You may use your rectangle or square as an example in your explanation.

LEARNING EXTENTIONS

Assessments:

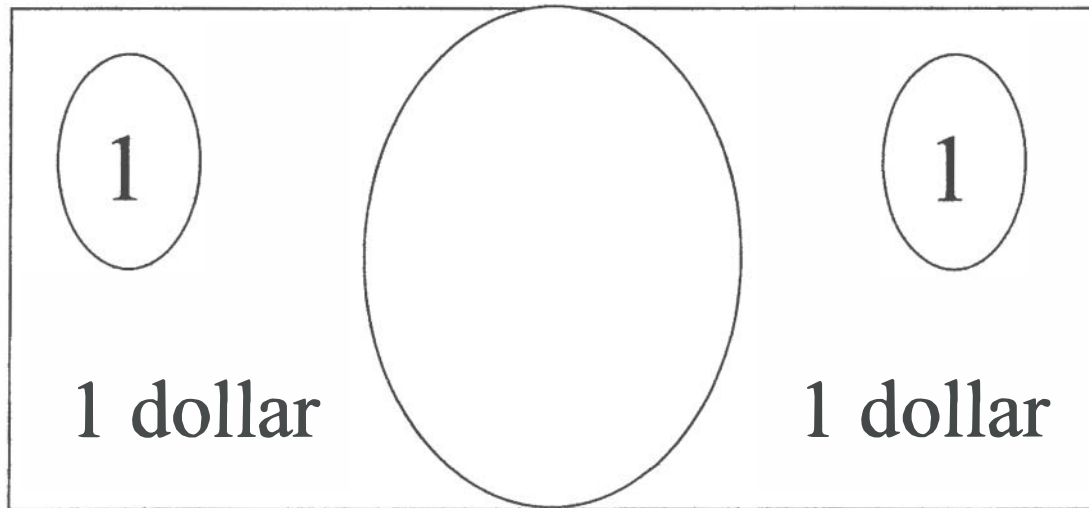
- Several checks for understanding during the lesson
- Sit in on group discussion, redirection where necessary
- Grade their group work
- Grade their homework and how well they work in groups

Homework:

Worksheet on finding the area and perimeter of rectangles

Transparency

How do you find the area and perimeter of a rectangle or square the fast way?



Area = _____ inches²

Perimeter = _____ inches

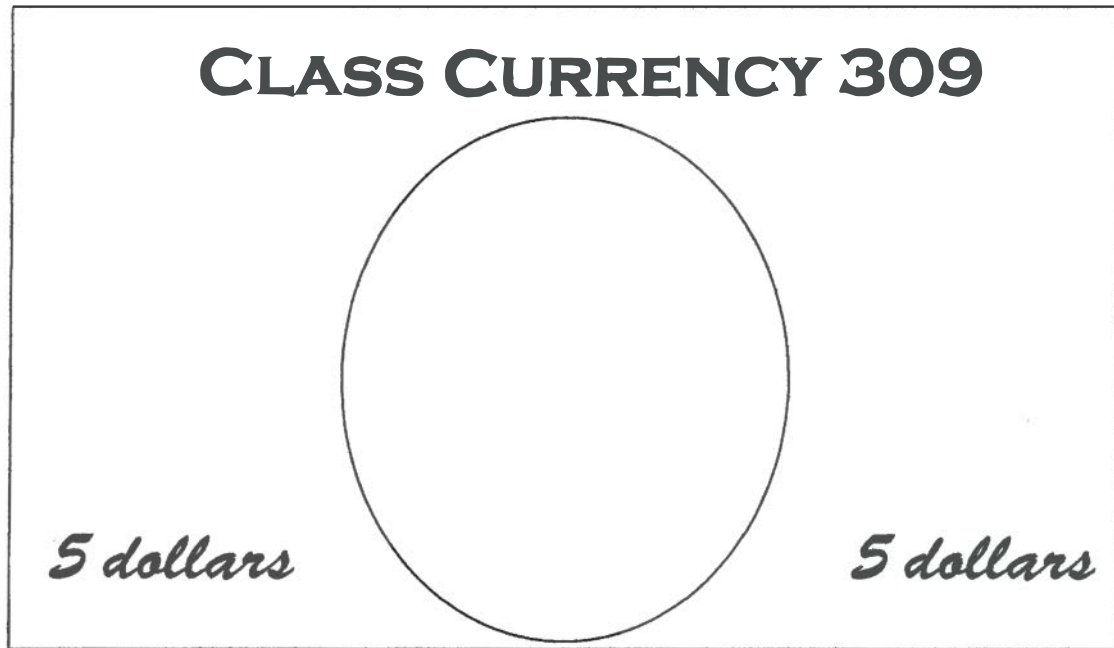
Name _____

Homebase _____

Date _____

Group work #1 for lesson 3

First measure the dimensions of the bill, then find the area and perimeter of our \$5.00 bill in class currency. Show your work.



Length of the bill = _____ cm

Width of the bill _____ cm

Area = _____ cm²

Perimeter = _____ cm

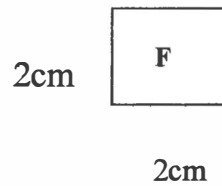
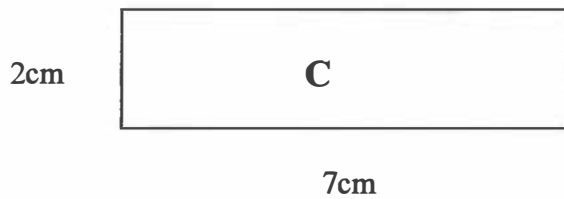
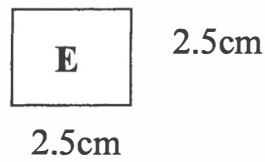
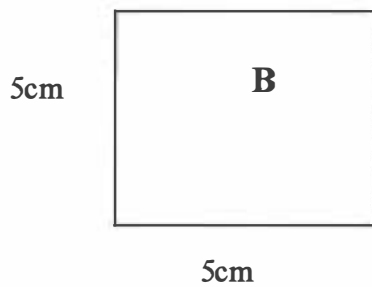
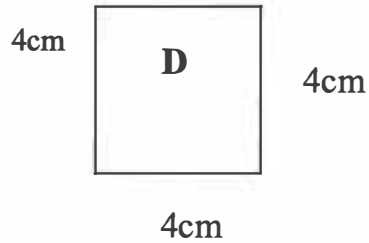
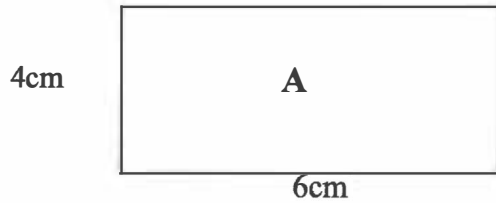
Name _____

Homebase _____

Date _____

Group work 2 for lesson 3

Find the area and perimeter of the following rectangular prisms and answer the following questions. Show your work on a different sheet of paper if necessary.



Area of Rectangle A = _____

Perimeter of Rectangle A = _____

Area of Rectangle B = _____

Perimeter of Rectangle B = _____

Area of Rectangle C = _____

Perimeter of Rectangle C = _____

Area of Rectangle D = _____

Perimeter of Rectangle D = _____

Area of Rectangle E = _____

Perimeter of Rectangle E = _____

Area of Rectangle F = _____

Perimeter of Rectangle F = _____

1. What is the difference in area between rectangle A and rectangle B?

Answer _____

2. What is the sum of the areas of square E and Square F?

Answer _____

3. How many E squares can fit inside of square B? Note: Neither of the two squares is to scale, so you wont be able to tile Square B with Square E. Show your work.

Answer _____

Name _____

Homebase _____

Date _____

Homework 3

Show your work. I strongly suggest that you draw a picture you help you solve each of the following problems.

1. A football field is 360ft long and 160 feet wide. What is the area and perimeter of a football field?

Area = _____

Perimeter = _____

2. A football field is 120 yards by 53.3 yards. What is the area and perimeter of the field?

Area = _____

Perimeter = _____

3. A soccer field is 330 feet long and has an area of $79,200\text{ft}^2$. Find the perimeter and width of a soccer field.

Width = _____

Perimeter = _____

4. How much greater is the area of a soccer field than the area of a football field?

Answer = _____

5. A baseball infield is square shaped and has an area of 872 yards^2 . Find the distance between the bases.

Answer _____

What is the full distance around all of the bases, starting and finishing at home-plate.

Answer _____

Name _____

Homebase _____

Date _____

Homework 3

1. What is the area of a square that has an edge of length 5cm? _____
2. What is the perimeter of the square of question 1? _____
3. What is the length of an edge of a square with an area of 36ft^2 ? _____
4. What is the area of a square that has an edge length of 2.6cm? _____
5. What is the difference in area of a square with edges of length 10ft and a square with edges of length 4ft? _____
6. What is the length of an edge of a square with a perimeter of 48mm?

7. What is the perimeter of a square that has an area of 81ft^2 ? _____
8. What is the area of a square with a perimeter of 64? _____

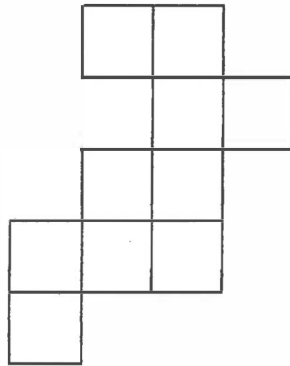
Name _____

Homebase _____

Date _____

Quiz 1

1. Find the area and perimeter of the following irregular polygon made up of cm squares.



a. Area = _____

How did you find your answer? _____

b. Perimeter = _____

How did you find your answer? _____

2. What is the area and perimeter of a boxing ring that is 16ft by 16ft?

Show your work.

Area = _____

Perimeter = _____

3. What is the area and perimeter of a volleyball court that is 18m by

9m? Show your work.

Area = _____

Perimeter = _____

4. What is the length and perimeter of a football field that has a width of

53.3 yards and an area of 6,400yds²?

a. What is the length of a football field? _____

b. What is the perimeter of the field? _____

Every football season, grass seed is planted 3 months prior to the season opening game. They use the most expensive, toughest grass there is. The grass seed costs \$10 per bag and each bag covers an area of 9 square yards.

How many bags of grass seed are needed to cover the entire football field?

Show your work.

Answer _____

The Rochester Instructional Framework

Lesson Plan 4

Lesson Topic:

Forming polygons and finding area and perimeter

NYS Learning Standard

Standard 2

Students will measure and transfer measured lengths to the sides of rectangles.

Thereafter, students will find the area and perimeter of those rectangles.

Standard 3

Students will further their understanding of the concept of area and perimeter. Students will gain confidence in problem solving while working together cooperatively. The students will apply the concept of area and perimeter in a real world setting with good real world examples and illustrations for them to relate to.

Standard 4

Students will understand and apply the scientific concept of area to find the area of various things that appear in the real world.

Standard 5

Students will use measurement skills to find the lengths and width of a rectangle to answer questions pertaining to its area and perimeter.

Standard 7

Real life problems will be used throughout the lesson.

Modeling/Multiple Representation:

Students will recognize the formula and the use of the variables A, L, and W for area, length, and width respectively. They will also recognize the various multiplication symbols used in mathematics

Measurement:

Students will use the cm side of their ruler to measure the length and width of various rectangles. Thereafter, they will find the area by multiplying the rectangles dimensions.

LESSON PREPERATION

Objective:

Students will take cut up rectangles and piece them together to form irregular polygons and then find the area and perimeter of their polygons.

Essential Question:

How do you find the area and perimeter of an irregular polygon?

Materials:

- Worksheet for homework or class practice
- Cut out rectangles
- Rulers
- Glue
- Paper to glue the polygons to

WORKSHOP

Bridge: Warm-up

Show them a pictures of various brick walls. Show them that all those bricks cover the entire surface and therefore the area of all the bricks together is equal to the area of the wall.

Mini-lesson: teacher directed

Demonstrate how to find the area and perimeter of an irregular polygon by the putting together the brick shaped piece of paper to cover the walls with a brick pattern.

Work time

Give the student various pieces of paper to cut into a rectangle to form a rectangle shapes. They will then find the area and the perimeter of each rectangle shaped piece of paper using the centimeter side of their ruler. In groups, they will put the rectangle shaped pieces of paper together to form an irregular polygon. They will then tell me the area and

perimeter of their groups' irregular polygon formed from the various rectangles put together.

Thereafter, they will work on a worksheet where they have to find the area and perimeter of irregular polygons by cutting them into rectangles. What they do don't complete becomes homework.

Summary

Have students show their various irregular polygons formed in their groups giving its area and perimeter.

LEARNING EXTENTIONS

Assessments:

I will observe how much they understand the concept by sitting in on their group work, answering questions and guiding. I will also assess by collecting their group work and check their homework tomorrow.

Homework:

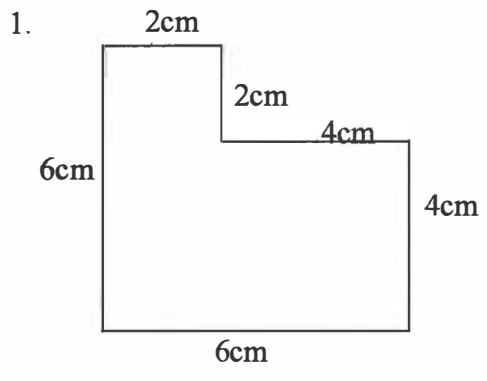
Finish the worksheet from class or a new worksheet on the same subject.

Name _____
Math 8

Date _____
HB _____

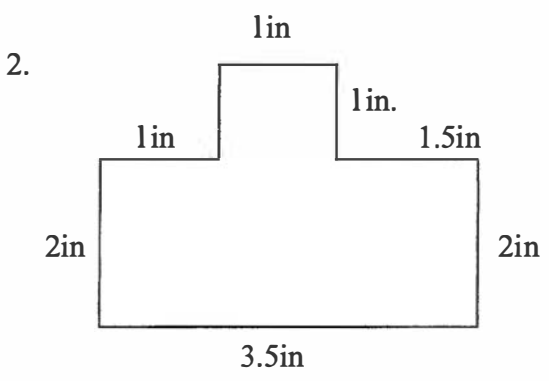
Group work 4

Find the area and perimeter of the following irregular polygon shaped circuit boards.



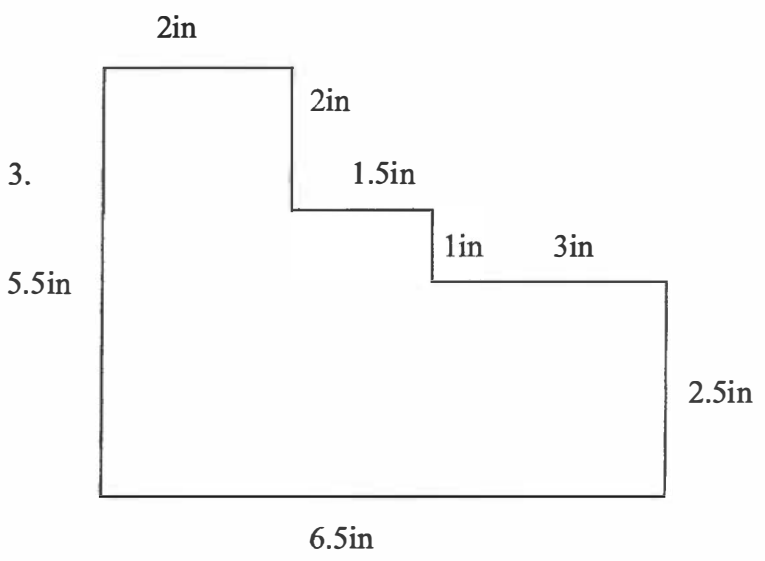
Area = _____

Perimeter = _____



Area = _____

Perimeter = _____

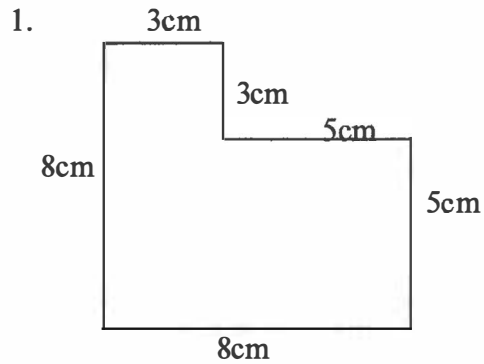


Area = _____

Perimeter = _____

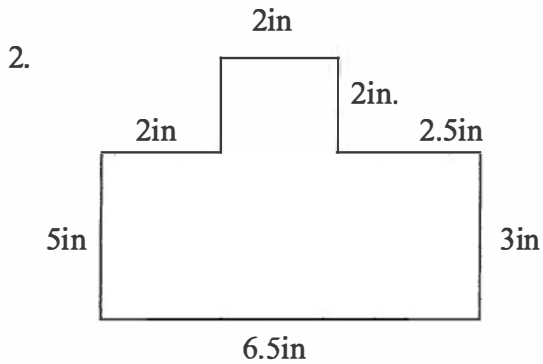
Homework 4

Find the area and perimeter of the following irregular polygon shaped circuit boards.
Show your work.



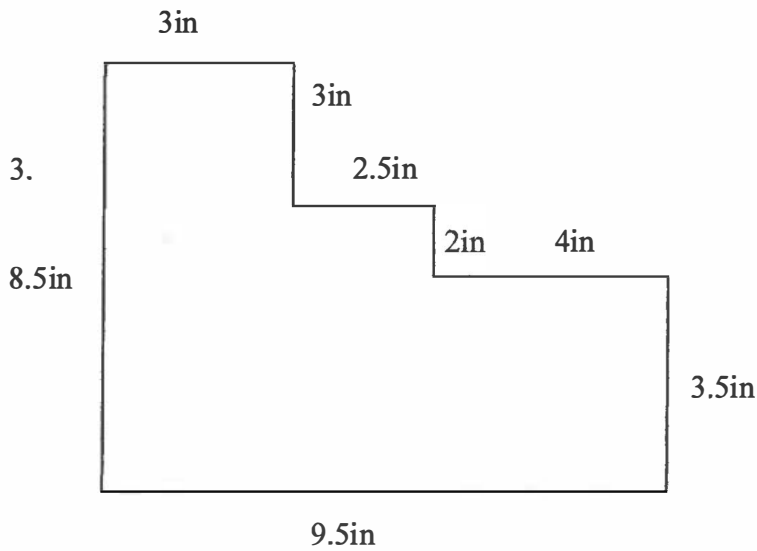
Area = _____

Perimeter = _____



Area = _____

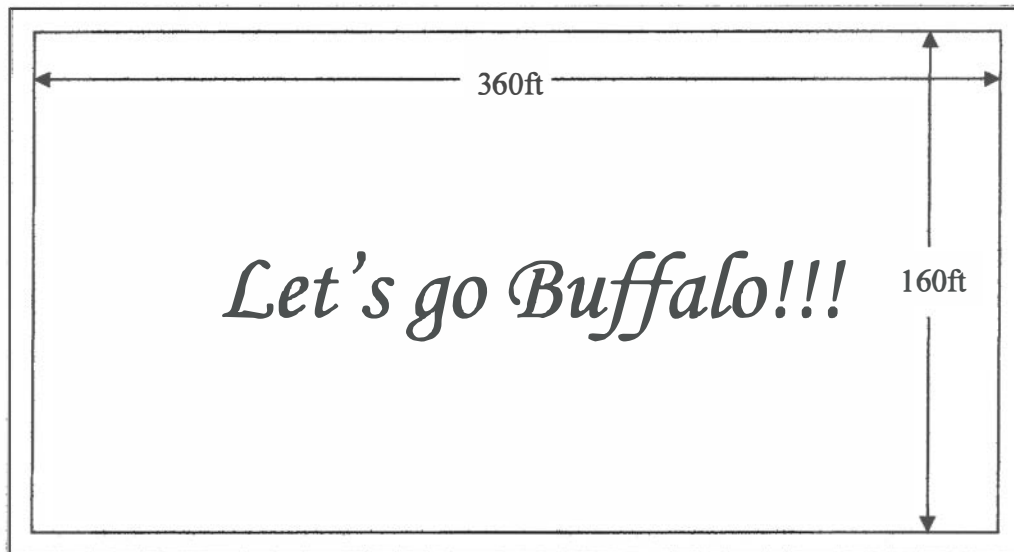
Perimeter = _____



Area = _____

Perimeter = _____

Recall, a football field is 360ft by 160ft. The perimeter line of the football field is 4 inches wide. What is the area of the white paint perimeter of the football field? Use the drawing below to help you solve this problem.



Answer _____

If the paint costs \$7 a can and each can covers 50 square feet, how many buckets of paint will be needed to paint the perimeter of the football field? Show your work.

Answer _____

How much will it cost to paint the perimeter of the football field? Show your work.

Answer _____

The Rochester Instructional Framework

Lesson Plan 5

Lesson Topic:

Finding the area and perimeter of irregular polygons continued

NYS Learning Standard

Standard 1

Students will use scientific inquiry by trying to figure out a way of finding the area of a shaped region. I will guide their responses where needed.

Standard 3

Students will gain mathematical confidence by communicating in group activities.

Together they will reason mathematically while trying to find the area of shaded regions.

Standard 7

Students will work together applying their knowledge of how to find the area of a rectangle to address a real life problem.

Key Ideas

Mathematical Reasoning:

Students will extend their understanding of area by finding the area of “shaded regions”.

It requires mathematical reasoning to understand how to do this type of problem.

Operations:

Students will subtract the area of one rectangle from another to find the area of a shaded region. This problem requires use of subtraction and multiplication in a real world problem involving area.

Modeling/Multiple Representation:

Students will use rectangles to represent swimming pools and other real things. They will use rectangular areas on paper to symbolize the area and dimensions of pools and cement areas around a pool. They will understand what shaded regions are and how they are used to model real areas.

Measurement:

Students will measure area and use lengths and widths to find the area of a pool.

LESSON PREPERATION

Objective:

- Practice finding the area and perimeter of polygons
- Teach how to find the area of a polygon with a polygon shape cut out of it

Essential Question:

How do you find the area of a polygon with a polygon shape cut out of it?

Materials:

- worksheets
- paper
- cut out rectangles
- construction papers
- scissors
- rulers

WORKSHOP

Bridge: Warm-up

- Continue with football field example from yesterday's homework assignment.
- How much will it cost to put cement around a rectangular swimming pool?

Mini-lesson: teacher directed

- Show them a simple example of how to find the area of such a shape by cutting a rectangle out of a rectangular piece of construction paper. Asking, "How do we find the area of this shape?" Let them know that the piece of paper is serving as a model for the cement area surrounding a pool
- Demonstrate how to find the area of such an area
- Solicit ideas from the students
- Give one more concrete example of another pool's cement area for the kids to gain more confidence in the process and reasoning

Work time

- Give the students the problem introduced at the beginning of the lesson and see if they can work collaboratively to find the answer to the question.
- Have them continue by cutting out a model of such an area with construction paper and find the area and perimeter of it
- Have them trace the smaller rectangle on to the larger rectangle then cut that shape out
- Have them find the area of their pool's cement area
- Begin worksheet in groups/ consider changing groups next class

Summary

Have students share their shape's area and how they found it. Thereafter, they can find the area of similar shapes on a worksheet.

LEARNING EXTENTIONS

Assessments:

- Several checks for understanding
- Sit in on group work
- Critique group presentations
- Assess understanding of group work as well as homework.

Homework:

Worksheet on finding the area of shaded regions

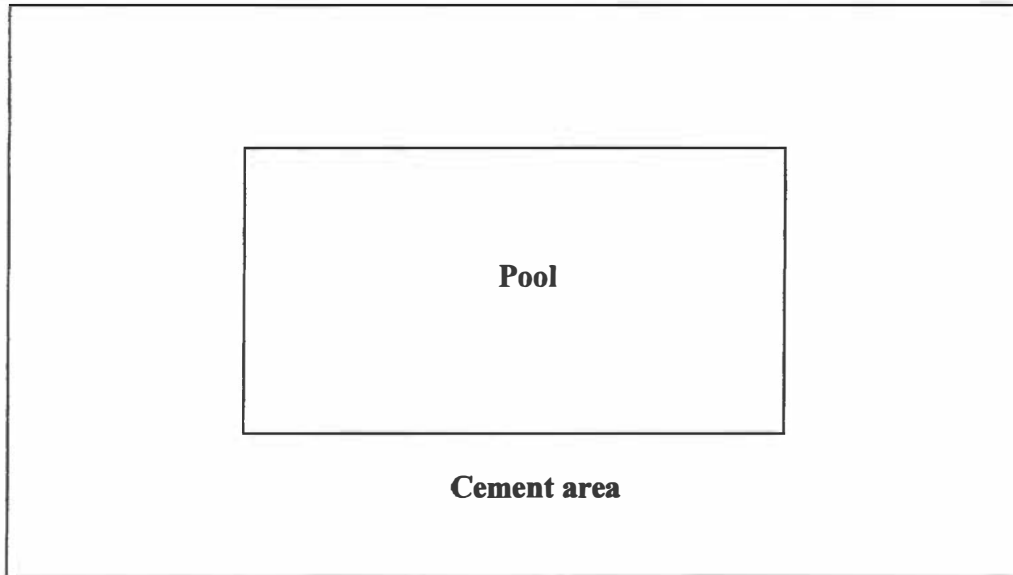
Name _____

Homebase _____

Date _____

Group work 5

Below is a drawing of a swimming pool with cement round about. The actual swimming pool is 20 feet by 40 feet. The patio portion is 70 feet by 40 feet. Find the area of the pool and the area of the cement area around it. **Show your work.**



Area of the pool _____

Area of the cement area _____

If it costs \$30 per square inch of cement to cement the patio area around the pool, how much will it cost to lay the cement area around the pool? **Show your work.**

Answer _____

Juan wants to put flowers around the perimeter of the pool. The flowers cost 1.25 each. He wants to put one flower every foot around the pool. How much will it cost to put flowers around the pool? Don't forget to include the 8.25% tax on the total cost.

Answer _____

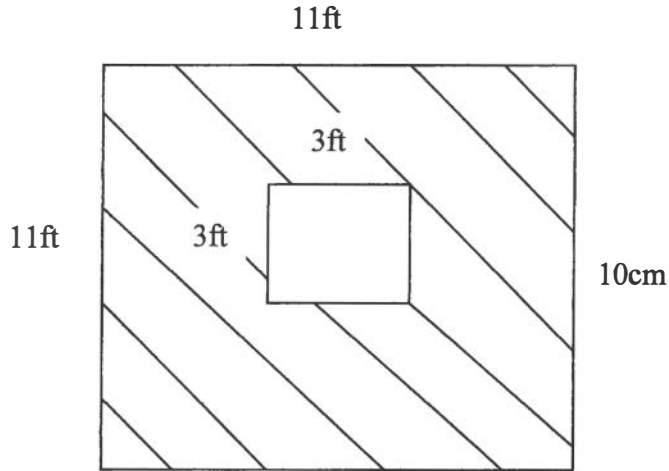
Name _____
Math 8

Date _____
HB _____

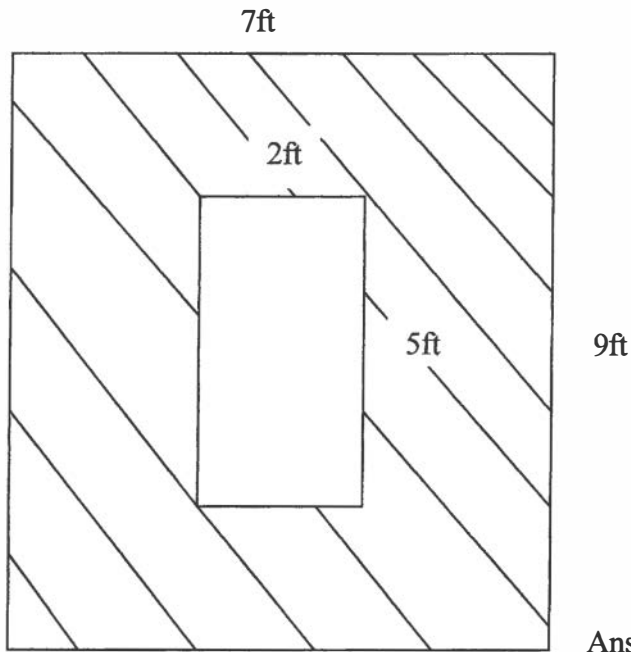
Homework 5

Find the area of the following shaded garden regions. You must show your work.

1.



Answer = _____ ft^2



Answer = _____ ft^2

The Rochester Instructional Framework

Lesson Plan 6

Lesson Topic:

More on finding the area and perimeter of polygons (Extension)

NYS Learning Standard

Standard 1

Students will use scientific inquiry by trying to figure out a way of finding the area of a shaped region. I will guide their responses where needed.

Standard 3

Students will gain mathematical confidence by communicating in group activities. Together they will reason mathematically while trying to find the area of shaded regions.

Standard 7

Students will work together applying their knowledge of how to find the area of a rectangle to address a real life problem.

Key Ideas

Mathematical Reasoning:

Students have to reason to understand how to find the lengths of missing side lengths in order to find the area of a rectangle that can be created within a shape.

Modeling and Multiple Representations:

Students will use models for real items and find the area of the model in order to find the area of the real-world item.

Measurement:

The concept of area is extended in this lesson to include another differently shaped polygon and how to find its area and perimeter.

LESSON PREPERATION

Objective:

- extend the concept of finding the area of a polygon with another polygon cut out of it
- extend finding the area and perimeter of a polygon
- introduce prime numbers using them as the polygons dimensions
- introduce perfect squares as dimensions

Essential Question:

How do you find the area and perimeter of various irregular polygons?

Materials:

- magnetic strips to serve as sides of the polygon
- Worksheets
- Cut out polygons
- Rulers
- Scissors

WORKSHOP

Bridge: Warm-up

Find the area and perimeter of the following polygon.

Introduce a problem to be considered: “I want to paint the side of a stair case. How much paint is needed, exactly?” Walk through the process for finding the cost of the paint needed to paint the side of the stair case.

Mini-lesson: teacher directed

- Teach the students how to find the area and perimeter of a step-shaped polygon with given dimensions.
- Using my magnetic strips as the sides of the step-shaped polygon I will demonstrate that the sides add up to be another length that can be used to find the length of a missing side.

Work time

In groups: Give the students step-shaped polygons on paper. Have them first measure its sides to find its area and perimeter. They will find the area by cutting the rectangle into rectangles.

Give students a few minutes to draw in their notes and find their area and perimeter.

Summary

Have students continue to work together on a worksheet. Give them the answers to the first few problems to make sure they're doing it correctly.

LEARNING EXTENTIONS

Assessments:

- Several checks for understanding
- Frequent visits to each group to assure they are working on the problems correctly
- Collect group work and give feedback

Homework:

Worksheet

Name _____

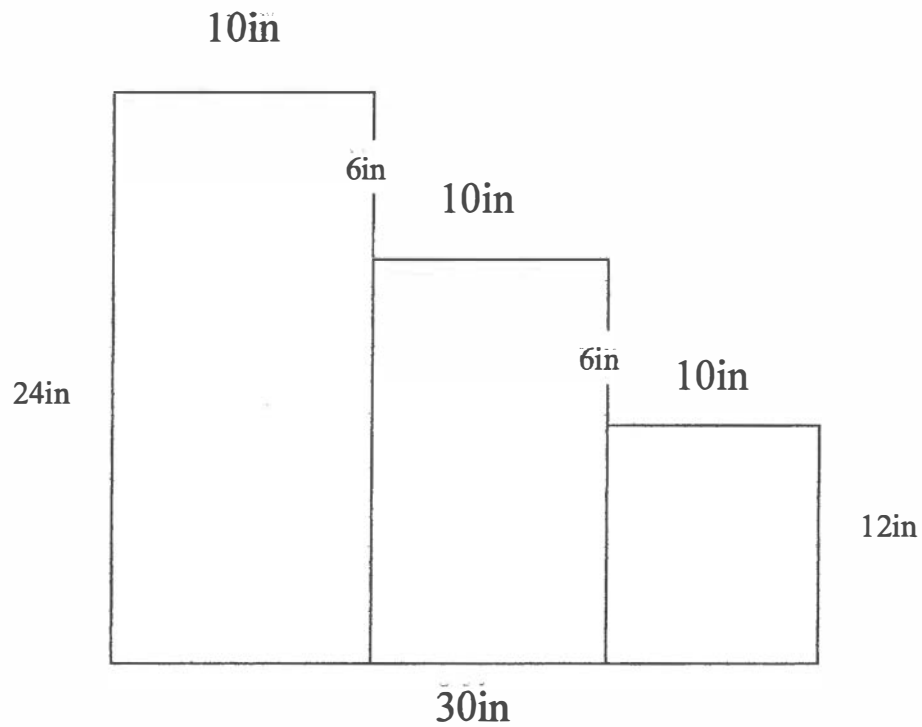
Homebase _____

Date _____

Transparency for lesson 6

There is a problem.

- I want to tile my staircase with square $.5\text{in}$ by $.5\text{in}$ tiles
- How many tiles will I need to buy?



What is the area of the side view of the staircase?

Answer _____

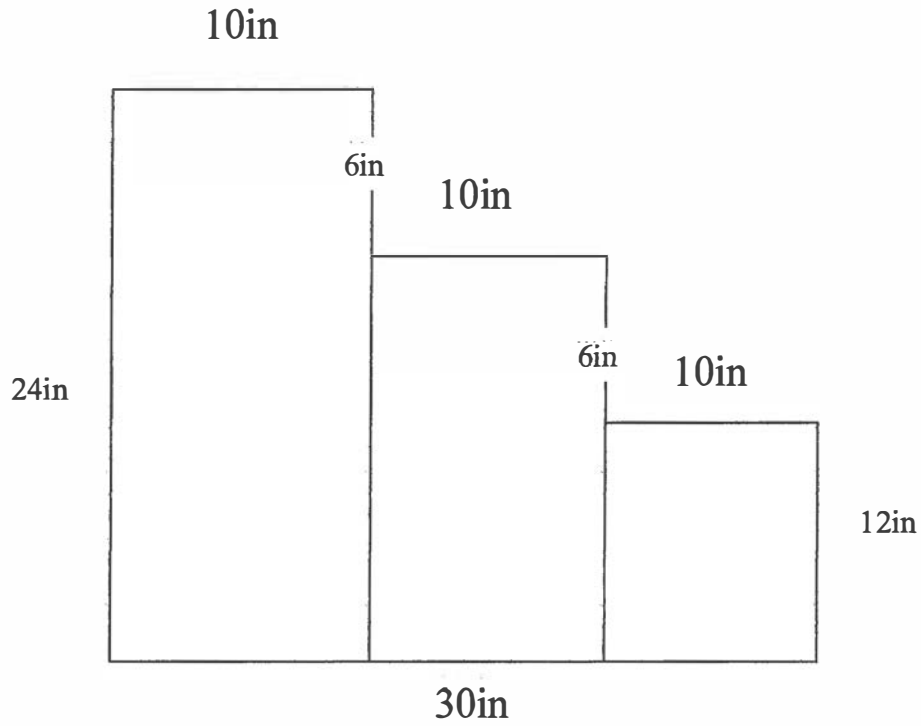
2. How much will it cost to tile the entire side view of the stair case with precious .5in by .5in stones? Each stone costs \$.25 each. How much will it cost to tile the side of the staircase with those stones? Don't forget the tax in New York State is 8.25 %.

Name _____

Homebase _____

Date _____

Group work 6



What is the area of the side view of the staircase?

Answer _____

2. How much will it cost to tile the entire side view of the stair case with precious 1 in by 1 in stones? Each stone costs \$.25 each. How much will it cost to tile the side of the staircase with those stones? Don't forget the tax in New York State is 8.25 %.

3. How much would it cost to tile the entire side view of the staircase with precious .5 by .5 inch stones that cost 5 cents each? Don't forget the tax in New York State is 8.25%.

Answer _____

4. How much money will you have if you choose the cheaper choice of the two?
Show your work.

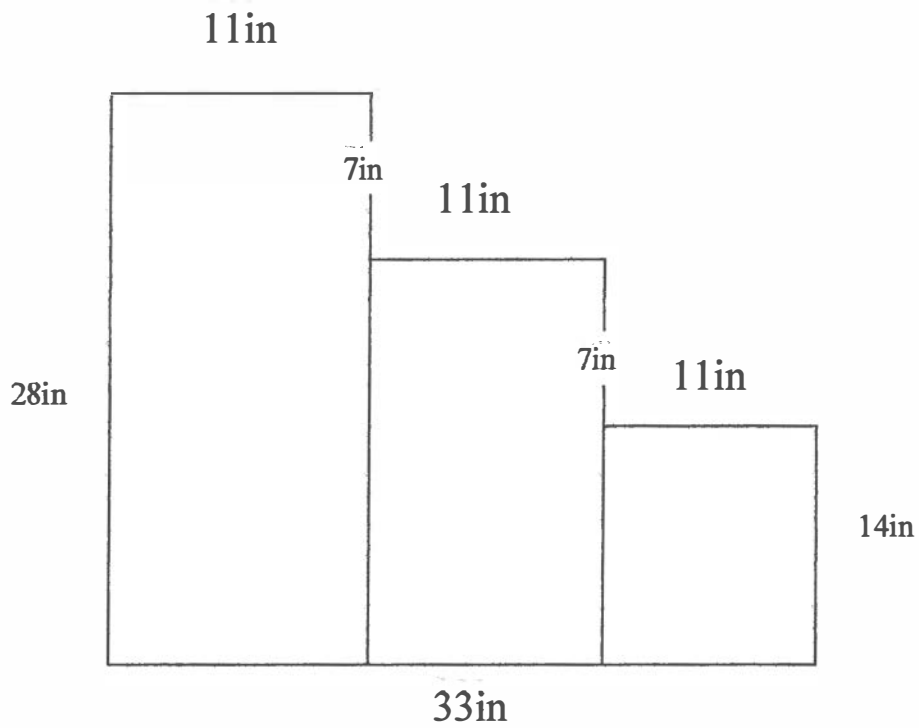
Answer _____

Name _____

Homebase _____

Date _____

Homework 6



What is the area of the side view of the staircase?

Answer _____

2. How much will it cost to tile the entire side view of the stair case with precious 1 in by 1 in stones? Each stone costs \$.35 each. How much will it cost to tile the side of the staircase with those stones? Don't forget the tax in New York State is 8.25 %.

3. How much would it cost to tile the entire side view of the staircase with precious .5 by .5 inch stones that cost 8 cents each? Don't forget the tax in New York State is 8.25%.

Answer _____

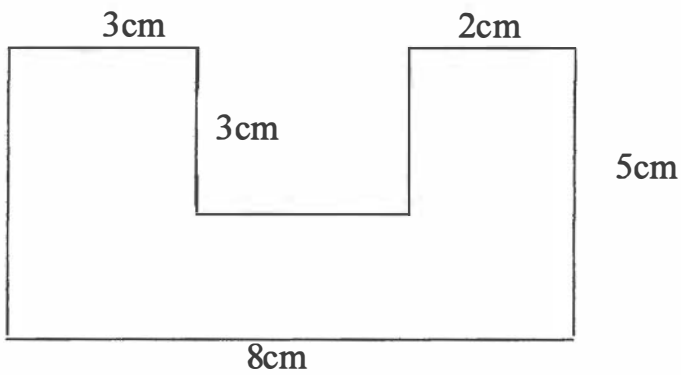
4. How much money will you have if you choose the cheaper choice of the two?
Show your work.

Answer _____

Name _____
Math 8

Date _____
HB _____

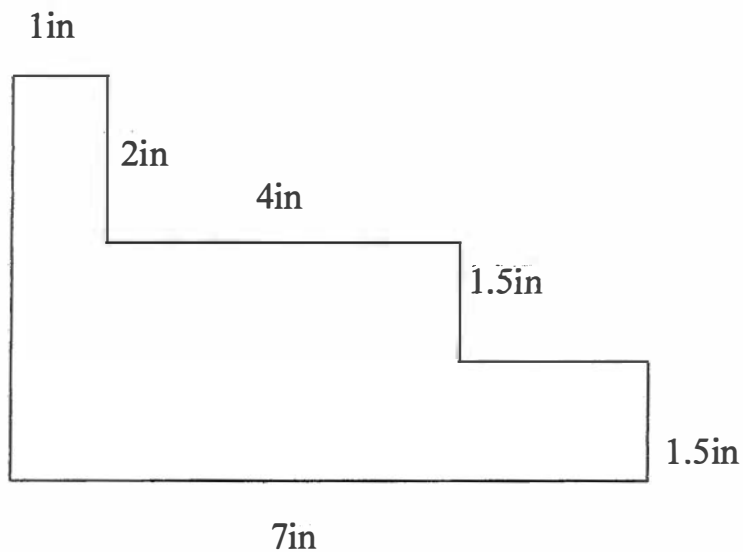
1. What are the area and the perimeter of the following polygon? **Show your work.**



Area = _____ cm^2

Perimeter = _____ cm

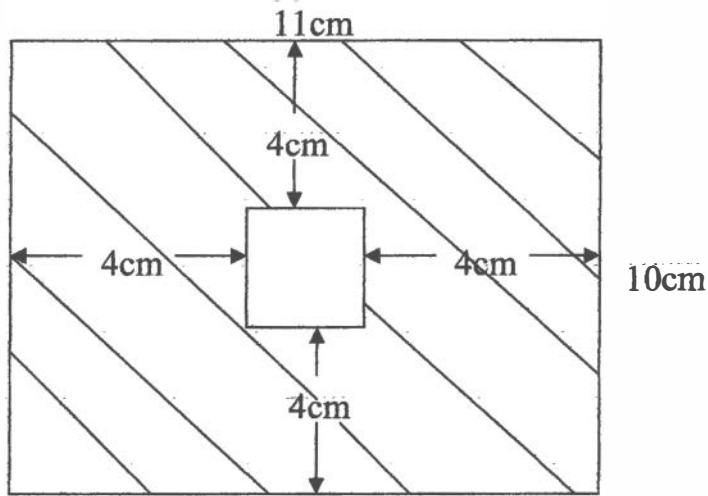
2. Find the area and the perimeter of the following polygon. **Show your work.**



Area = _____ in^2

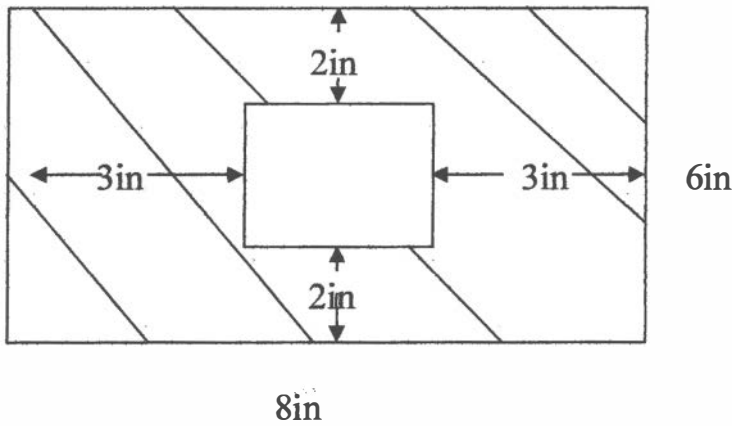
Perimeter = _____ in

3. Find the area of the following shaded region. **Show your work.**



Area = _____

4. Find the area of the following shaded region. **Show your work.**



Area = _____

Name _____

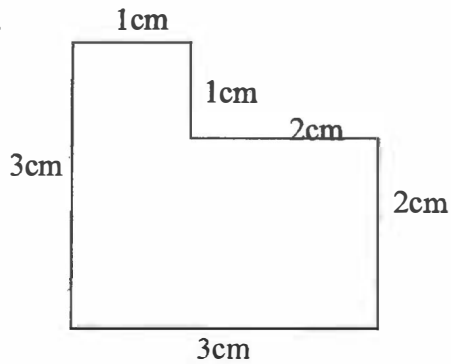
Homebase _____

Date _____

Quiz 2

Find the area and perimeter of the following irregular polygon shaped circuit boards.

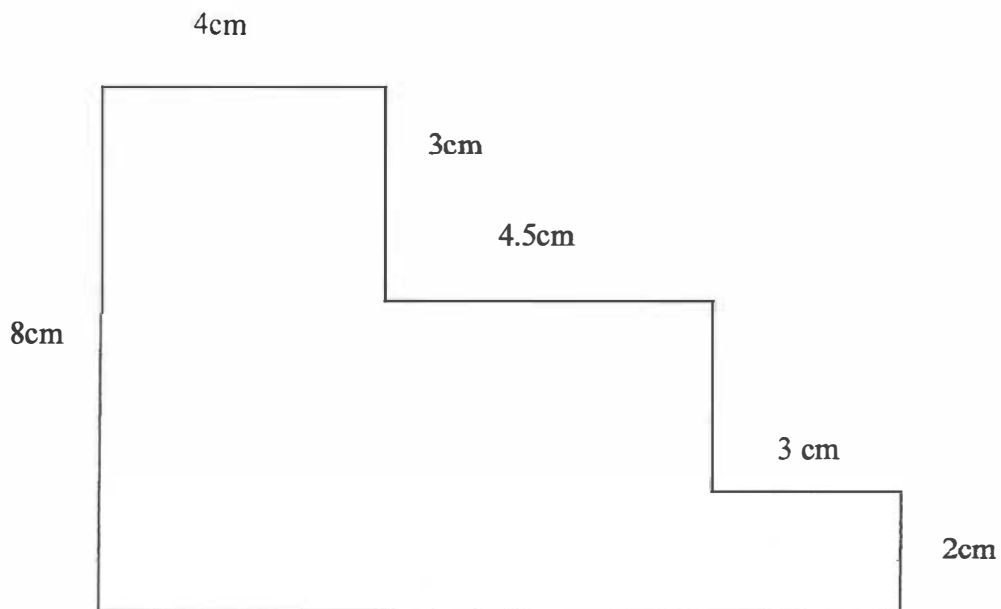
1.



Area = _____

Perimeter = _____

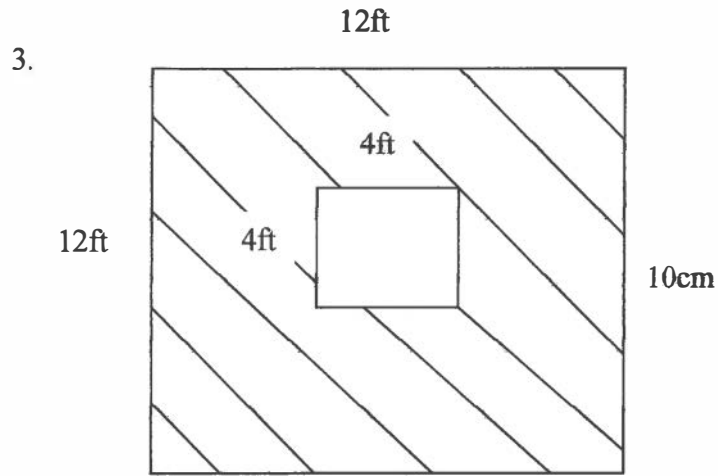
2.



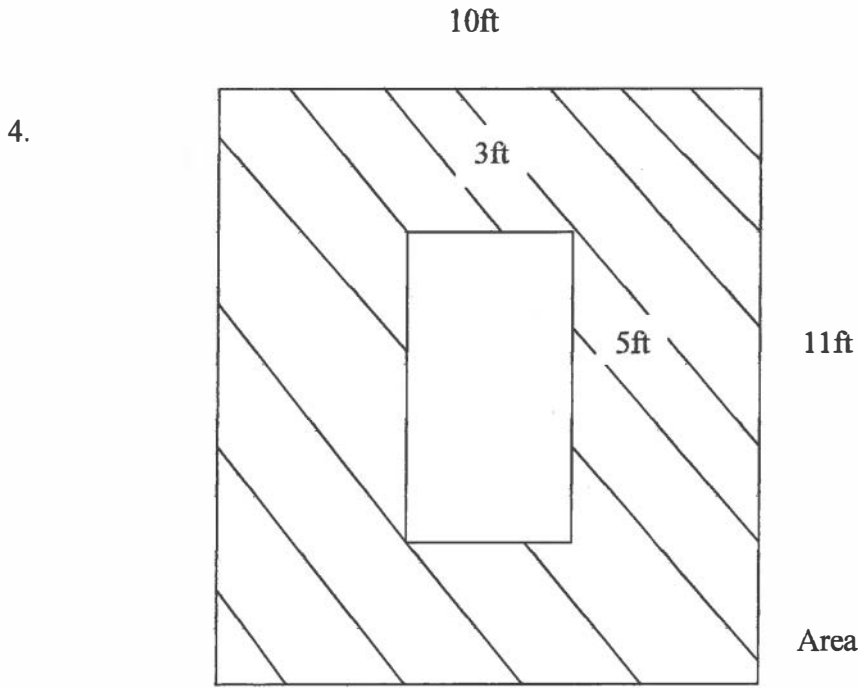
Area = _____

Perimeter = _____

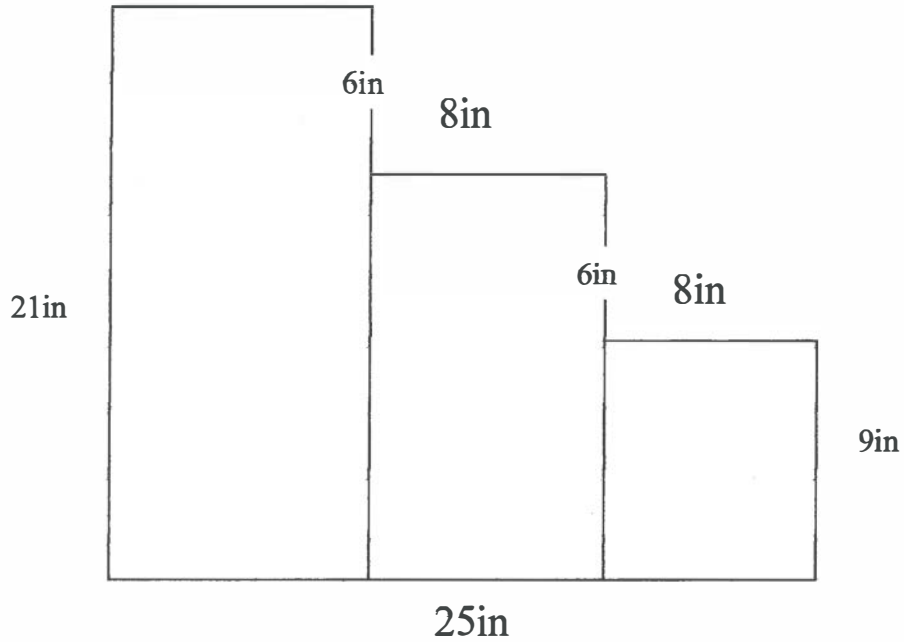
Find the area of the following shaded garden regions. You must show your work.



Answer = _____ ft^2



Area = _____ ft^2



5. What is the area of the side view of the staircase? Show your work.

Answer _____

6. How much will it cost to tile the entire side view of the staircase with precious 1 in by 1 in stones? Each stone costs \$.35 each. How much will it cost to tile the side of the staircase with those stones? Don't forget the tax in New York State is 8.25 %. Show your work.

Answer _____

The Rochester Instructional Framework

Lesson Plan 7

Lesson Topic:

Teach what a rectangular prism is

NYS Learning Standard

Standard 2

Students will measure using a ruler and calculate area using calculators. Students will transfer measurements on to a worksheet.

Standard 3

Students will further their understanding of area. Students will further their mathematical confidence working in cooperative groups. Students will continue to work on real world problems.

Standard 4

Students will understand the and apply the scientific concept of area and its purpose in measuring things.

Standard 6

Students will understand the relationship mathematics has with boxes that they see everywhere, including packaging science.

Standard 7

Students will apply the concept of volume to real life problems.

Modeling/Multiple Representation:

Students learn how to draw rectangular prism. This skill will be needed throughout the study of rectangular prisms.

Measurement:

Students will learn what the three dimensions of a rectangular prism are. They will be able to recognize and measure the dimension of the base of a rectangular prism as well as the height of the prism. They will use the inch side of their ruler to measure the dimensions of their boxes in their groups.

LESSON PREPERATION

Objective:

- Students will learn how to identify a rectangular prism
- Students will learn what a face is, an edge
- Learn how many faces a rectangular prism has
- The difference between a cube and a rectangular prism
- Length, width, height

Essential Question:

What is a rectangular prism?

Materials:

- Boxes of various shapes and sizes
- A box for each group
- A worksheet to be filled out during group work

WORKSHOP

Bridge: Warm-up

Hold up a cereal box. Ask the kids, “Why does cereal usually come in a box like this?”

Hold up a few other real world rectangular prism shaped boxes they would recognize.

Tell them it is a rectangular box or rectangular prism. Begin the discussion of what properties the boxes have and what makes them recognizable as rectangular boxes or prisms.

Mini-lesson: teacher directed

- How do you know it's a box?
- Wordsplash about its properties
- In their notes give them the definition of rectangular prism
- Students will learn how to identify a rectangular prism
- Students will learn what a face is, an edge
- How many faces a rectangular prism has

- The difference between a cube and a rectangular prism
- the dimensions of a rectangular prism

Work time

Students work in groups. Each group gets a box. They will have to measure its length, width, and height. In this lesson they will use inches as their unit of measure. They will also have to find the dimensions of their box's base. Their group work will be accompanied with a worksheet.

Summary

Have the students present their box and the answer to the questions on the worksheet.

LEARNING EXTENTIONS

Assessments:

- Several checks for understanding throughout the lesson
- Sitting in on group discussions
- Assess the group presentations
- Assess homework tomorrow

Homework:

Worksheet on the properties of a rectangular prism

Name _____

Homebase _____

Date _____

Group Work 7

1. How many edges does your rectangular prism have? _____

2. Measure the length of the twelve edges of your box. Use the cm side of your ruler.

Edge 1 = _____

Edge 7 = _____

Edge 2 = _____

Edge 8 = _____

Edge 3 = _____

Edge 9 = _____

Edge 4 = _____

Edge 10 = _____

Edge 5 = _____

Edge 11 = _____

Edge 6 = _____

Edge 12 = _____

3. What are the dimensions of your rectangular prism?

Length _____ Width _____ Height _____

4. What are the dimensions of the base of your rectangular prism?

Length _____ Width _____

5. What is the area of your rectangular prism's base? _____ cm^2

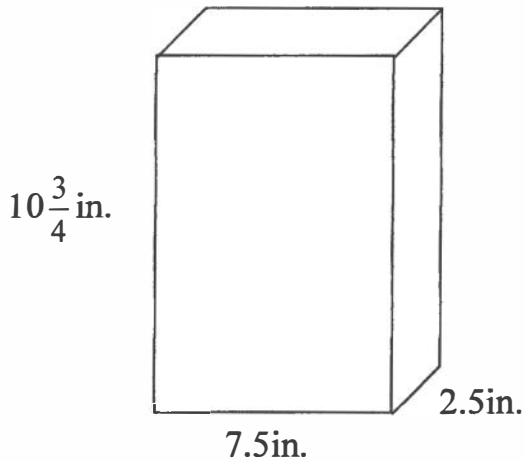
Name _____

Homebase _____

Date _____

Homework 7

1. Answer the questions below about the sketch of the accompanying Corn Pops cereal box.



- a. What are the dimensions of the base of a Pops cereal box?

Length _____ Width _____

- b. What are the dimensions of the front face?

Length _____ Width _____

- c. What are the dimensions of the side face?

Length _____ Width _____

- d. What are the dimensions of the rectangular prism shaped box?

L = _____ in W = _____ in H = _____

2. What is the area of the base of the rectangular prism shaped box?

Answer _____

3. What is the area of the side face of the rectangular prism?

Answer _____

4. What is the area of the front face?

Answer _____

5. How much larger is the front face than the side face? (subtract the area of the side face from the area of the front face to find the answer)

Answer _____

6. How much larger is the side face than the base?

Answer _____

The Rochester Instructional Framework

Lesson Plan 8

Lesson Topic:

Area and perimeter of flat patterns of rectangular prisms

NYS Learning Standard

Standard 3

Students will work cooperatively finding the area of flat patterns of rectangular prisms.

In groups they will build vocabulary and gain mathematical confidence.

Standard 6

Students will understand the role mathematics plays in the technology of packaging things.

Key Ideas

Modeling/Multiple Representation:

We will use flat patterns of rectangular boxes as a means for understanding later concepts, namely surface area.

Measurement:

Students will find the area of the six faces of the rectangular prism. Students will also recognize the base of a rectangular prism and know how to measure its area.

LESSON PREPERATION

Objective:

- Students will learn what a flat pattern of a rectangular prism is
- Students will learn how to find the area and perimeter of a flat pattern
- Students will be able to describe the dimensions of the rectangular prism the flat pattern would fold into

Essential Question:

How do you find the area and perimeter of a flat pattern of a rectangular prism?

Materials:

- pre-cut rectangular prism flat patterns
- worksheets

WORKSHOP

Bridge: Warm-up

Find the area and perimeter of the following rectangular prism's flat patterns. Hold up a rectangular box with six faces. Rip it until it opens completely. Entertain the students; act a little silly. Hold it up in a cross shape. Tell them, "This is a flat pattern of a rectangular box or rectangular prism."

Mini-lesson: teacher directed

- Demonstrate how to fold a flat pattern into and out of a rectangular prism shape
- Review what a face is
- Review the number of faces
- Review 12 edges
- Review of dimensions
- The dimensions: l , w , and h
- Teach how to find the area of each face
- Teach how to find the area and perimeter of a flat pattern
- Teach how to find the area of the base of a prism

Work time

Have the students work together folding flat patterns into and out of rectangular prisms. They will find the area of each face, the dimensions of each rectangular prism, and the dimensions of each face. They will also find the area and perimeter of the flat pattern.

Summary

Have the students share their flat pattern and the answers to their worksheet.

LEARNING EXTENTIONS

Assessments:

- Several checks for understanding during my lesson

- Sit in on group work to assess the conversations
- Assess presentation of group work
- Assess homework

Homework:

Homework 8

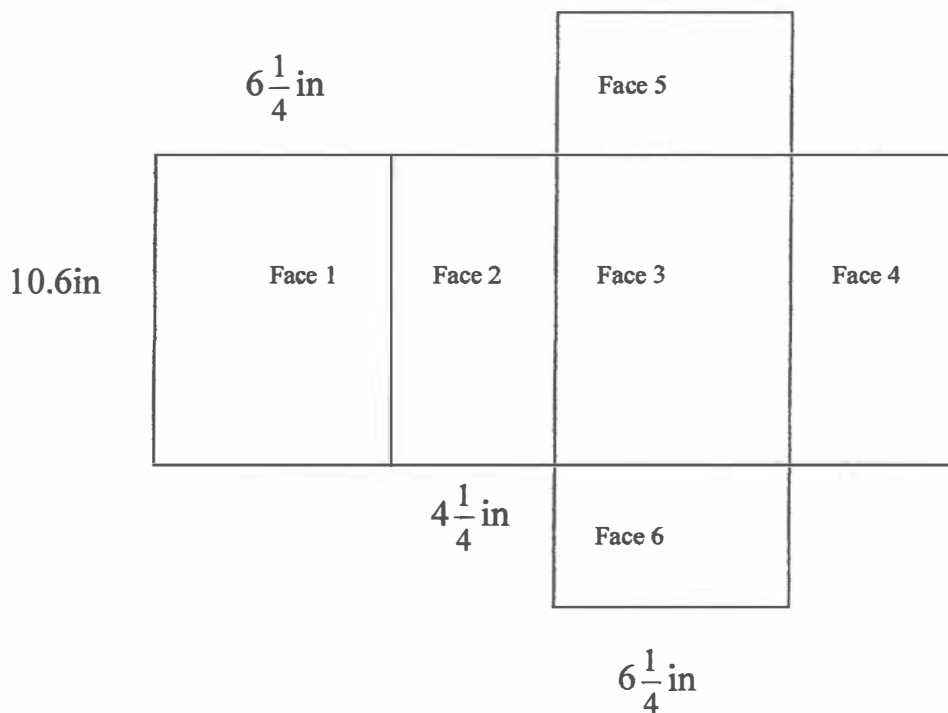
Name _____

Homebase _____

Date _____

Group Work 8

Below is a flat pattern of a Glad bag box.. Answer the questions that follow.



1. Label the length of all of the outside edges of the flat pattern.

2. Find the area of each face.

a. area of face 1 = _____

b. area of face 2 = _____

c. area of face 3 = _____

d. area of face 4 = _____

e. area of face 5 = _____

f. area of face 6 = _____

3. The area of the flat pattern can be found by adding the area of all 6 faces together. What is the area of your flat pattern? Show your work.

Area of the flat pattern = _____

4. What will the dimensions of the Saltine Cracker box be when it is folded into a rectangular prism?

Length = _____ Width = _____ Height = _____

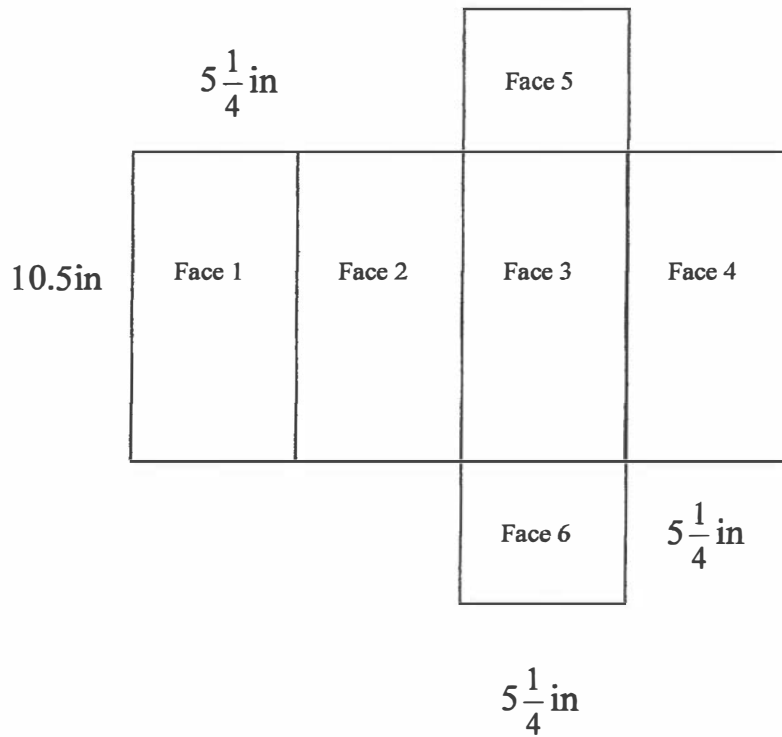
Name _____

Homebase _____

Date _____

Homework 8

Below is a flat pattern of a Glad bag box.. Answer the questions that follow.



1. Label the length of all of the outside edges of the flat pattern.

2. Find the area of each face.

a. area of face 1 = _____

b. area of face 2 = _____

c. area of face 3 = _____

d. area of face 4 = _____

e. area of face 5 = _____

f. area of face 6 = _____

3. The area of the flat pattern can be found by adding the area of all 6 faces together. What is the area of your flat pattern? Show your work.

Area of the flat pattern = _____

4. What will the dimensions of Saltine Cracker box be when it is folded into a rectangular prism?

Length = _____ Width = _____ Height = _____

The Rochester Instructional Framework

Lesson Plan 9

Lesson Topic:

Surface area of rectangular prisms

NYS Learning Standard

Standard 3

Students will understand what surface area is and its general purpose. Students will work collaboratively on the group activity strengthening their mathematical communication.

Standard 4

Students will apply what they have learned and understand how it relates to physical settings and where the knowledge of surface area is needed.

Key Ideas

Operations:

Students will find the area of all 6 faces and add them together to find the surface area of a rectangular prism.

Modeling/Multiple Representation:

Students will draw and recognize rectangular prisms as models for something that is real and useful in the understanding and solving of problems involving surface area.

Measurement:

Students understand length, width, and height and their use in finding the area of each face and finally the surface area of a rectangular prism.

LESSON PREPERATION

Objective:

Students will learn how to find the surface area of a rectangular prism given its dimensions

Essential Question:

How do you find the surface area of a rectangular prism?

Materials:

WORKSHOP

Bridge: Warm-up

Students will find the area and perimeter of a rectangular prism's flat pattern drawn on inch grid paper.

Mini-lesson: teacher directed

- Teach the students what surface area is
- Teach the students how to find the area of each face using a real rectangular prism. Draw it on the board to go into their notes
- Label the dimensions
- Draw the six rectangles separately
- Find the area of each rectangle
- Add the areas of all six faces together

Work time

Students will work in groups on a worksheet on how to find the surface area of a rectangular prism.

Summary

Go over first few problems from the worksheet. After fifteen minutes of group work, continue to walk around the class answering questions.

LEARNING EXTENTIONS

Assessments:

- Several checks for understanding during the lesson: praises of student suggestions and answers

- Listen in on group discussions extend the conversations where possible and praise collaborative groups that exemplify their purpose.
- Call on particular students to offer their solutions to the problem

Homework:

Finish the worksheet for homework.

Name _____

Homebase _____

Date _____

Group work 9

1. My television came in a box that was 20in by 18in by 21 inches. How much cardboard is needed to make the box? To help you answer the question, sketch the box and label its dimensions.

Answer _____

2. How much material is needed to make a wooden jewelry box for your mother that is 10in by 7in by 3in? To help you answer the question, sketch the box and label its dimensions.

Answer _____

3. My biggest book at home is 11.3in by 3in by 9.5in. The box that it came in was 11.5 in by 3.2 in by 9.7 inches. How much material was the box made out of that my encyclopedia came in? To help you answer the question, sketch the box and label its dimensions.

Answer _____

4. The wood necessary to make the jewelry box in problem 2 is very expensive; it is sold by the square inch. Each square inch of wood is a quarter. How much will it cost to buy the wood needed to make the jewelry box in problem 2?

Answer _____

Name _____

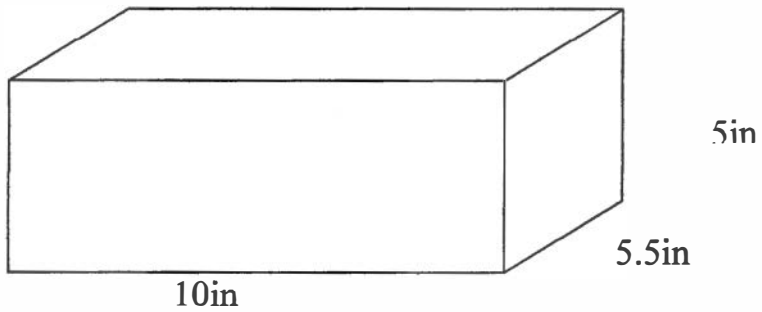
Homebase _____

Date _____

Homework 9

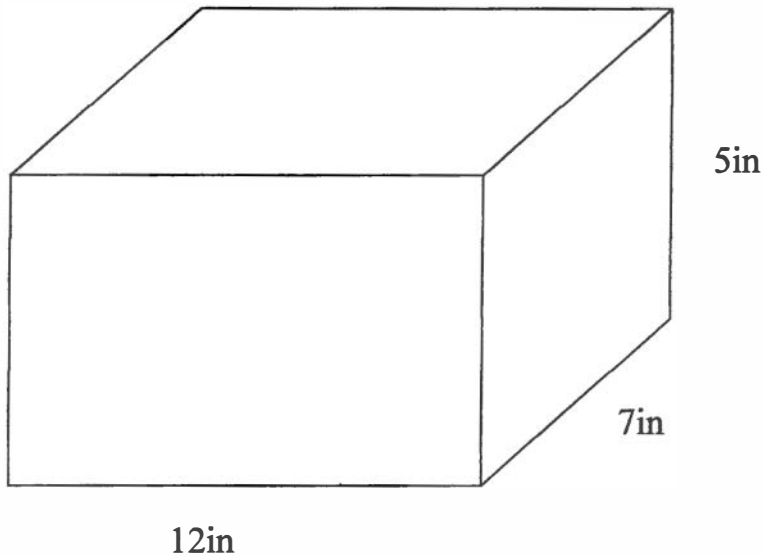
Find the surface area of the following rectangular prisms. Show your work.

1.



Surface area = _____ in²

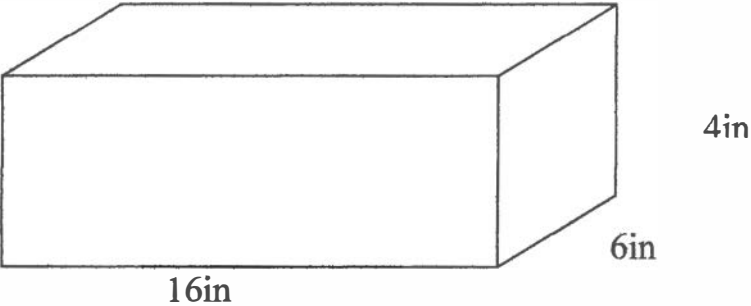
2.



Surface area = _____

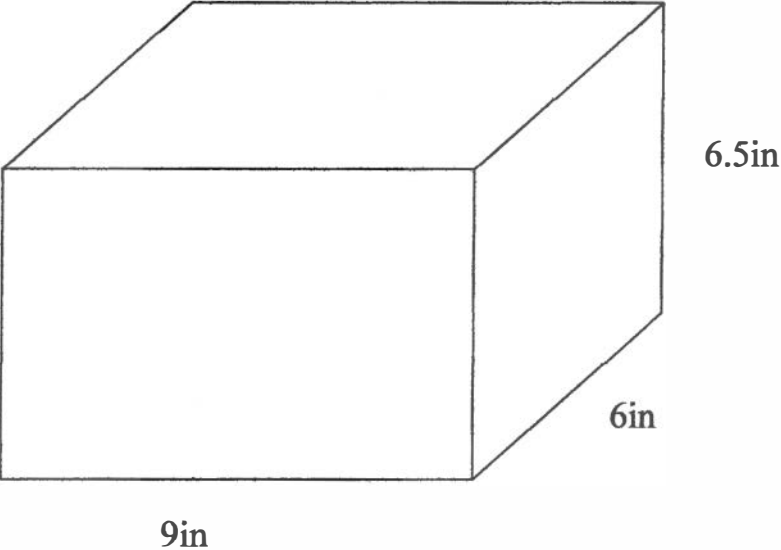
Find the surface area of the following rectangular prisms. Show your work.

1.



Surface area = _____ in²

2.



Surface area = _____

Name _____

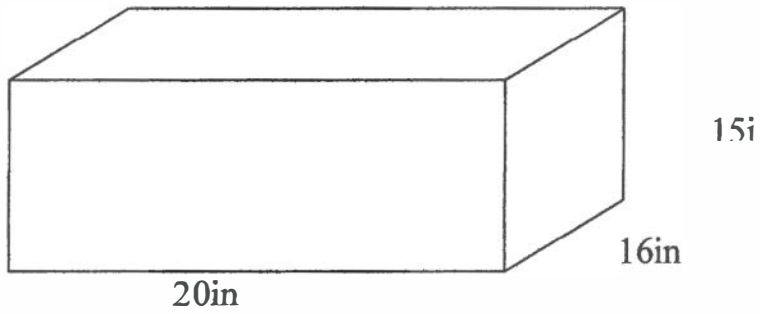
Homebase _____

Date _____

2nd Homework 9

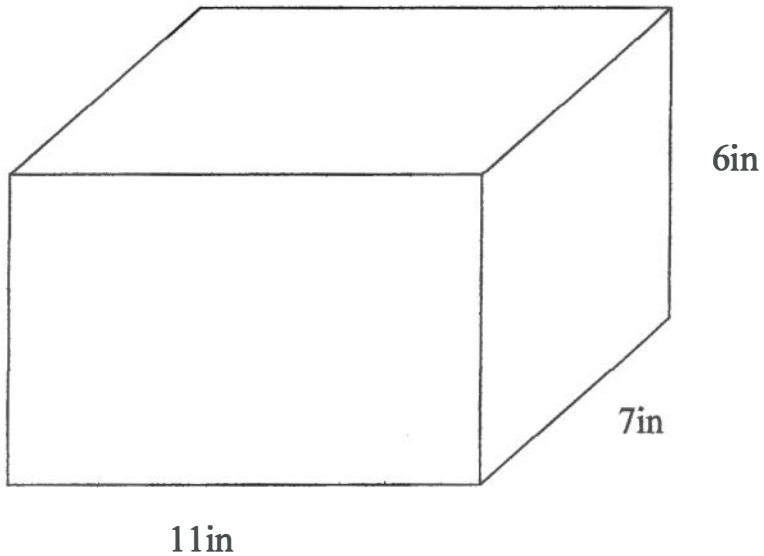
Find the surface area of the following rectangular prisms. Show your work.

1.



Surface area = _____ in²

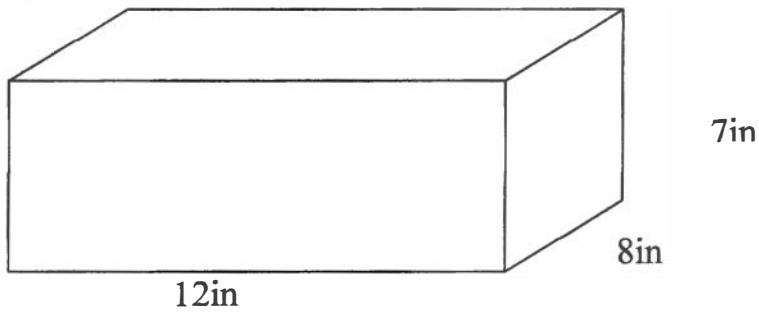
2.



Surface area = _____

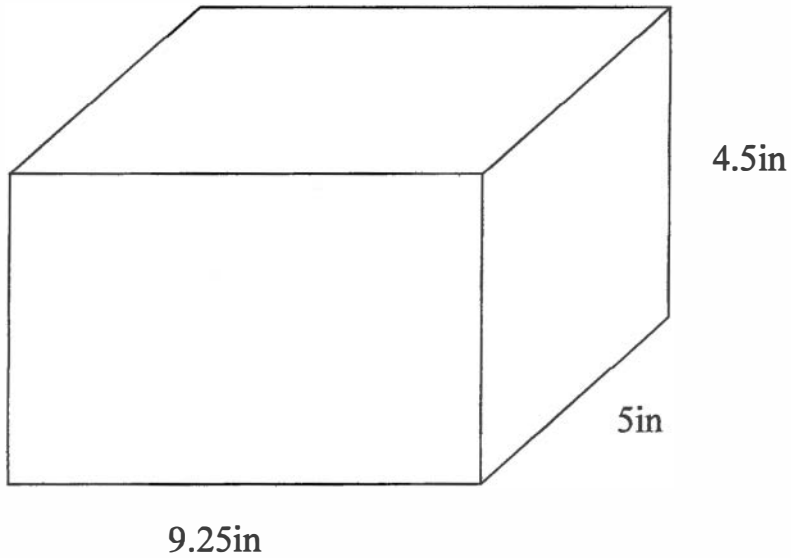
Find the surface area of the following rectangular prisms. Show your work.

1.



Surface area = _____ in²

2.



Surface area = _____

Name _____

Homebase _____

Date _____

Review Homework 9

No calculators allowed! Show your work!

1. What is the area of a square with a width of 17 inches and a length of 2 feet?

Answer _____

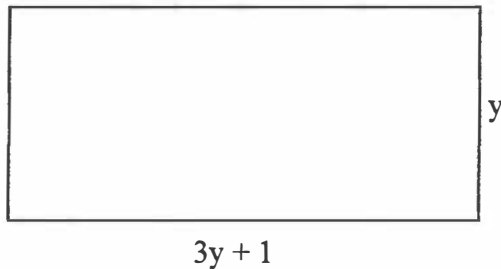
2. What is the area of a face of a rubics cube? Its dimensions are 3.1 by 3.1 inches.

Answer _____

3. A cabinet door is 20 inches wide and has an area of 3 feet long. What is the area of the wooden cabinet door?

Answer _____

4. What is the area and perimeter of the following rectangle?



Area = _____

Perimeter = _____

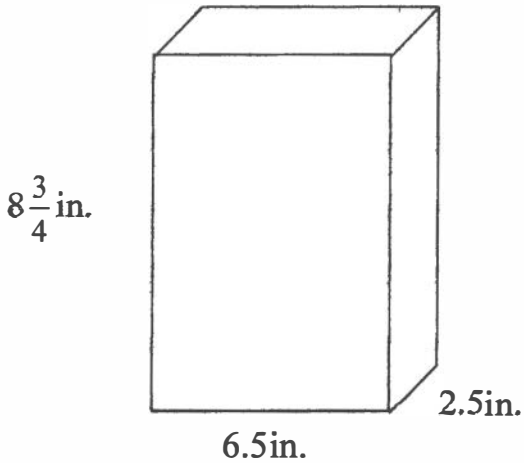
Name _____

Homebase _____

Date _____

Quiz 3

1. Answer the questions below about the sketch of the accompanying Corn Pops cereal box.



- a. What are the dimensions of the base of a Pops cereal box?

Length _____ Width _____

- b. What are the dimensions of the front face?

Length _____ Width _____

- c. What are the dimensions of the side face?

Length _____ Width _____

- d. What are the dimensions of the rectangular prism shaped box?

L = _____ in W = _____ in H = _____

2. What is the area of the base of the rectangular prism shaped box?

Answer _____

3. What is the area of the side face of the rectangular prism?

Answer _____

4. What is the area of the front face?

Answer _____

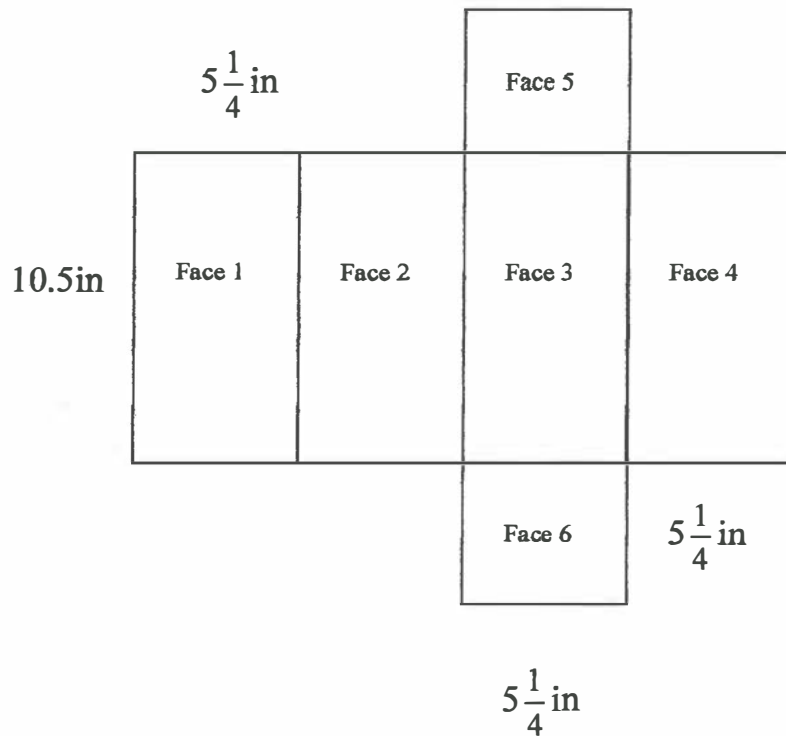
5. How much larger is the front face than the side face? (subtract the area of the side face from the area of the front face to find the answer)

Answer _____

6. How much larger is the side face than the base?

Answer _____

7. Below is a flat pattern of a Glad bag box.. Answer the questions that follow.



A. Label the length of all of the outside edges of the flat pattern.

B. Find the area of each face.

- area of face 1 = _____
- area of face 2 = _____
- area of face 3 = _____
- area of face 4 = _____
- area of face 5 = _____
- area of face 6 = _____

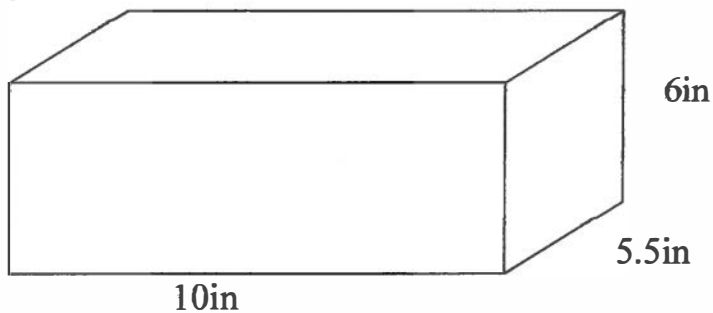
C. The area of the flat pattern can be found by adding the area of all 6 faces together. What is the area of your flat pattern? Show your work.

Area of the flat pattern = _____

D. What will the dimensions of Glad Bag box be when it is folded into a rectangular prism?

Length = _____ Width = _____ Height = _____

8. Find the amount of material needed to make this child's shoe box. Recall that the amount of material is the same as the surface area. Show your work.



Surface area = _____ in²

The Rochester Instructional Framework

Lesson Plan 10

Lesson Topic: volume of rectangular prisms

NYS Learning Standard

Standard 1

Students will use scientific inquiry and engineering design to make rectangular prisms from inch-cubes. They will seek various rectangular prisms that can be formed from 24 inch-cubes and seek the surface area of each prism they find.

Standard 2

Students will generate a chart and record data pertaining to all of the rectangular prisms they find.

Standard 3

Students will understand that volume is simply the counting of unit-cubes. Students will gain mathematical confidence while working in groups and communicating mathematically. The real world problem will be introduced during the lesson. They will be searching for all of the possible ways to package 24 toy blocks.

Standard 5

Students will use technological knowledge to construct various ways the 24 cubes can be packaged. They will evaluate the various boxes and determine which box will best suit the company's needs.

Standard 7

Students will apply what they know about rectangular prisms and their surface area and volume to answer various real life problems.

Key Ideas

Modeling/Multiple Representation:

Students will use inch-cubes to create rectangular prisms. They will understand that inch cubes are a fundamental unit of measure used to find the volume of a shape. They will use sketches of rectangular prisms with labeled dimensions to help them answer questions and visualize various rectangular prisms.

Measurement:

Students will be introduced to unit cubes as a fundamental unit of measure used to measure the amount of space something takes up. Students will measure volume by counting inch-cubes that comprise a shape.

Patterns/Functions:

Students will begin to take note of patterns in their charts. Hopefully, they will discover the relationship between a rectangular prism's three dimensions and its volume, as well as

its surface area and how it relates to its general shape. The more the prism looks like a cube, the less material needed to make the prism.

LESSON PREPERATION

Objective:

Students will learn what volume is and how to find it by counting unit cubes.

Essential Question:

How do you find the volume of a rectangular prism?

Materials:

Inch-cubes

worksheet

WORKSHOP

Bridge: Warm-up

Have students find the surface area of a rectangular prism.

Mini-lesson: teacher directed

- Teach the students how to make rectangular prisms out of cubes

- Demonstrate how to find the rectangular prism's volume and surface area by counting cubes and squares respectively and how to record them onto the sheet

Work time

Give the students 24 cubes and have them make rectangular prisms with all 24 cubes.

They will find the surface area, volume, and dimensions of each prism they find.

Summary

Have the students share their findings

Summarize by putting up a completed worksheet on the overhead and noting some patterns in the numbers. Especially the shapes and differing surface areas

LEARNING EXTENTIONS

Assessments:

Ongoing throughout the lesson

Homework:

Worksheet:

- find the number of cubes in each rectangular prism
- find the dimensions of each prism
- find the surface area of each prism

Answer the following questions about your filled in chart.

- a. Which rectangular prism has the greatest surface area? Remember, you describe a particular rectangular prism by its three dimensions.

Answer _____

- b. Which of your rectangular prisms has the least surface area?

Answer _____

- c. What is the difference in surface area between the prism with the least surface area and the prism with the greatest surface area?

Answer _____

- d. Sketch the prism with the least surface area; label its dimensions and describe its characteristics.

Characteristics:

- e. Sketch the prism with the greatest surface area. Label its dimensions and describe its characteristics.

Characteristics:

Name 2 major differences between the rectangular prism with the least surface area and the prism with the greatest surface area.

1. _____

2. _____

You and your group found all of the possible arrangements of 24 inch-cubes and found the surface area of each one.

Length	Width	Height	Volume	Surface Area
24in	1in	1in	24in^3	98in^2
12in	2in	1in	24in^3	76in^2
8in	3in	1in	24in^3	70in^2
6in	4in	1in	24in^3	68in^2
6in	2in	2in	24in^3	56in^2
4in	3in	2in	24in^3	52in^2

Greatest Surface Area: _____

Least Surface Area: _____

Name _____

Homebase _____

Date _____

Homework 10

You find all of the possible arrangements of 16 inch-cubes. Record your finding on the chart below.

Length	Width	Height	Volume	Surface Area
			16in ³	

Answer the following questions about your filled in chart.

- a. Which rectangular prism has the greatest surface area? Remember, you describe a particular rectangular prism by its three dimensions.

Answer _____

- b. Which of your rectangular prisms has the least surface area?

Answer _____

- c. What is the difference in surface area between the prism with the least surface area and the prism with the greatest surface area?

Answer _____

- d. Sketch the prism with the least surface area. Label its dimensions and describe its characteristics.

Characteristics:

- e. Sketch the prism with the greatest surface area. Label its dimensions and describe its characteristics.

Characteristics:

Name 2 major differences between the rectangular prism with the least surface area and the prism with the greatest surface area.

1. _____

2. _____

The Rochester Instructional Framework

Lesson Plan 11

Lesson Topic:

Surface area of rectangular prism extended

NYS Learning Standard

Standard 1

Students will use charts to analyze which arrangement of 24 cubes would cost the least to package.

Standard 2

Students will record data on a chart to analyze patterns in the data.

Standard 3

Students will understand, that although the volume of a prism may be the same, they will seldom have the same surface area. Students will use mathematics to address real world problems. Students will understand that much goes into consideration when making a box to package an item.

Standard 5

Students will use their technological knowledge to analyze which box the company should choose to package their blocks.

Standard 7

Students will use their knowledge of surface area and volume to address a real life problem, namely in which box they should package their blocks.

Key Ideas

Mathematical Reasoning:

Students will now consider the cost of material as it relates to building boxes. They will understand that it is better to box things cheaper and that it will lead to greater profit.

Measurement:

Measurement continues to be the core of the lesson. Students will continue to further their understanding of surface area and volume.

LESSON PREPERATION

Objective:

Students will understand that the cost of the box is directly affected by how much material is needed to make it .

Essential Question:

What affects the cost of building boxes?

Materials:

- transparency of the sheet filled out with all the possible dimensions
- sheets for each student of the transparency

WORKSHOP

Bridge: Warm-up

Find the surface area and the number of cubes that make up the prism.

Mini-lesson: teacher directed

- put up transparency
- note patterns and write them on the worksheet
- note which rectangular prism has the least surface area
- note which one has the greatest surface area
- note which box would cost the least to make
- note which box would cost the most to make
- Which box should you, the seller, buy? The one that costs the least.

Work time

Have student do the same type of problem but with a different number of cubes. 8, 9, 12, etc. Have them answer questions about which ones have the greatest and the least surface areas.

Summary

Have the students share their work with the class.

LEARNING EXTENTIONS

Assessments:

- Several checks for understanding
- Sit in on group discussions. Encourage and compliment students for working well in groups
- Assess presentation of material and oral communication when presenting group work
- Check completed class work and homework

Homework:

Worksheet/ Homework 11

You and your group found all of the possible arrangements of 24 inch-cubes and found the surface area of each one.

Length	Width	Height	Volume	Surface Area
24in	1in	1in	24in^3	98in^2
12in	2in	1in	24in^3	76in^2
8in	3in	1in	24in^3	70in^2
6in	4in	1in	24in^3	68in^2
6in	2in	2in	24in^3	56in^2
4in	3in	2in	24in^3	52in^2

Greatest Surface Area: _____

Least Surface Area: _____

Name _____

Homebase _____

Date _____

Class work 11

You and your group found all of the possible arrangements of 24.

Fill in the chart below.

Length	Width	Height	Volume	Surface Area
24in	1in	1in	24in^3	
12in	2in	1in	24in^3	
8in	3in	1in	24in^3	
6in	4in	1in	24in^3	
6in	2in	2in	24in^3	
4in	3in	2in	24in^3	

Which box would cost the most to make? _____

Which box would cost the least to make? _____

Name _____

Homebase _____

Date _____

Worksheet for lesson 11

Note some observations in the pattern of the numbers in the table below.

Length	Width	Height	Volume	Surface Area
24in	1in	1in	24in^3	98in^2
12in	2in	1in	24in^3	76in^2
8in	3in	1in	24in^3	70in^2
6in	4in	1in	24in^3	68in^2
6in	2in	2in	24in^3	56in^2
4in	3in	2in	24in^3	52in^2

Greatest Surface Area: _____

Least Surface Area: _____

Name _____

Homebase _____

Date _____

Group work 11

Find all of the possible arrangements of 8 inch-cubes into a rectangular prism. Fill in the chart below.

Length	Width	Height	Volume	Surface Area
			8in^3	

Which box would cost the most to make? _____

Which box would cost the least to make? _____

Find all of the possible arrangements of 9 inch-cubes into a rectangular prism. Fill in the chart below.

Length	Width	Height	Volume	Surface Area
			9in ³	

Which box would cost the most to make? _____

Which box would cost the least to make? _____

Find all of the possible arrangements of 12 inch-cubes into a rectangular prism. Fill in the chart below.

Length	Width	Height	Volume	Surface Area
			12in^3	

Which box would cost the most to make? _____

Which box would cost the least to make? _____

Name _____

Homebase _____

Date _____

Homework 11

Find all of the possible arrangements of 5 inch-cubes into a rectangular prism. Fill in the chart below.

Length	Width	Height	Volume	Surface Area
			5in^3	

Which box would cost the most to make? _____

Which box would cost the least to make? _____

Find all of the possible arrangements of 7 inch-cubes into a rectangular prism. Fill in the chart below.

Length	Width	Height	Volume	Surface Area
			7in^3	

Which box would cost the most to make? _____

Which box would cost the least to make? _____

Find all of the possible arrangements of 11 inch-cubes into a rectangular prism. Fill in the chart below.

Length	Width	Height	Volume	Surface Area
			11 in ³	

Which box would cost the most to make? _____

Which box would cost the least to make? _____

What did you notice about the possible rectangular arrangements of a prime number of inch cubes?

The Rochester Instructional Framework

Lesson Plan 12

Lesson Topic: The fast way to find the volume of a rectangular prism

NYS Learning Standard

Standard 1

Students will analyze the chart and discover that the volume of a rectangular prism can be found by multiplying the three dimensions.

Standard 3

Students will understand the concept of volume and its relationship to its dimensions.

Students will work together communicating mathematically about the volume of rectangular prisms.

Standard 7

Students will use the fact that the volume can be found by multiplying the three dimensions of a prism to find the volume of other prisms that occur in the real world.

Key Ideas

Patterns/Functions:

Students recognize that the less the difference is between the three dimensions of a rectangular prism, the less its surface area will be. Students also recognize the volume of

a rectangular prism can be found by multiplying its three dimensions by studying the pattern in the table. $\text{Volume} = \text{length} \times \text{width} \times \text{height}$ is discovered

LESSON PREPERATION

Objective:

Teach the students a fast way to figure out the volume of a rectangular prism

$\text{Volume} = \text{length} * \text{width} * \text{height}$

Teach what volume is

Essential Question:

How do you find the volume of a rectangular prism the fast way?

Materials:

The transparency for the problem with 24 blocks

Worksheets of that transparency for each student

WORKSHOP

Bridge: Warm-up

How many blocks does it take to make the prism?

What is the surface are of this prism?

What are these prisms' dimensions?

Mini-lesson: teacher directed

- Note patterns about the numbers in the chart for 24 cubes
- Note volume = length * width * height
- Fast way to find the volume discovered

Work time

Give the students a worksheet of rectangular prisms with given dimensions and have them find the volume of each one.

Summary

Have them answer the essential question and give their own examples of a rectangular prism and its volume.

LEARNING EXTENTIONS

Assessments:

- assess by questioning students

- assess their group work by sitting in on their discussions
- Assess their summary assignment

Homework:

Worksheet on surface area and volume of rectangular prisms

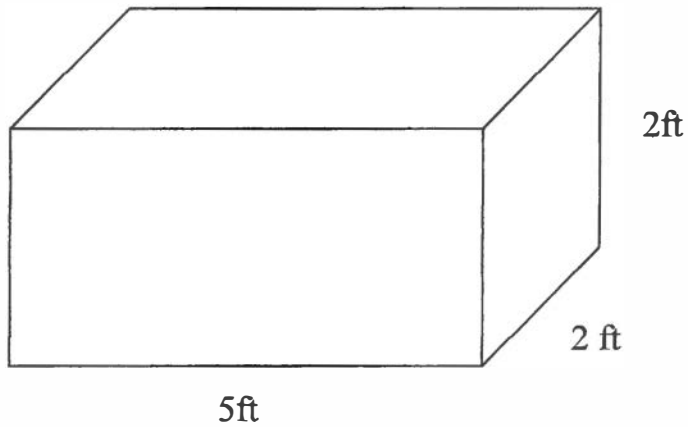
You and your group found all of the possible arrangements of 24 inch-cubes and found the surface area of each one.

Length	Width	Height	Volume	Surface Area
24in	1in	1in	24in^3	98in^2
12in	2in	1in	24in^3	76in^2
8in	3in	1in	24in^3	70in^2
6in	4in	1in	24in^3	68in^2
6in	2in	2in	24in^3	56in^2
4in	3in	2in	24in^3	52in^2

Notable Patterns:

Transparency 2

Find the volume of the following rectangular prism using the fact that the volume can be found by multiplying the three dimensions of the rectangular prism.



The length of the prism is _____

The width of the prism is _____

The height of the prism is _____

Volume = _____ x _____ x _____ = _____ cm^3

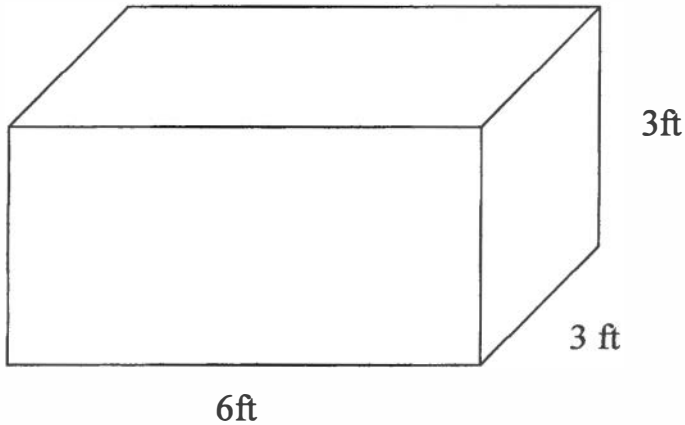
Name _____

Homebase _____

Date _____

Group Work 12

My snow-blower came in the following rectangular box. Find the volume of the box. Remember that volume can be found by multiplying the three dimensions of the rectangular prism.

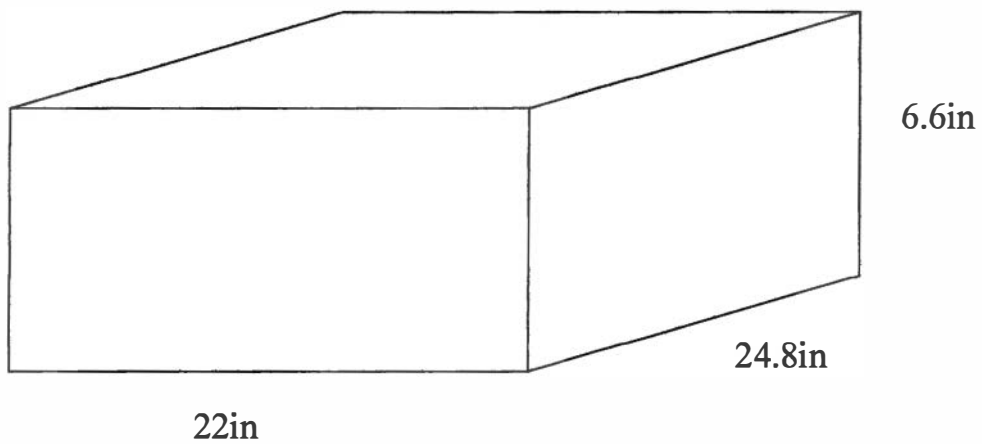


The length of the prism is _____

The width of the prism is _____

The height of the prism is _____

Volume = _____ x _____ x _____ = _____ ft^3



What are the three dimensions of the rectangular prism above?

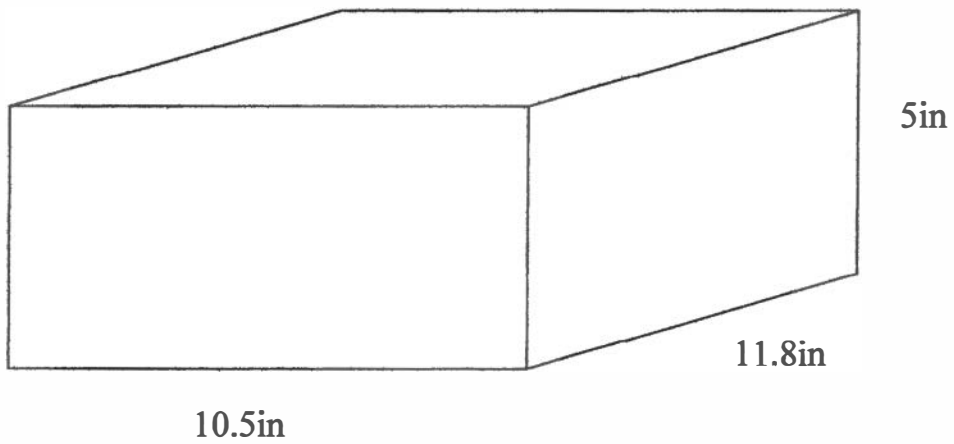
Length = _____

Width = _____

Height = _____

What is the volume of the rectangular prism?

Answer _____



What are the three dimensions of the rectangular prism above?

Length = _____

Width = _____

Height = _____

What is the volume of the rectangular prism?

Answer _____

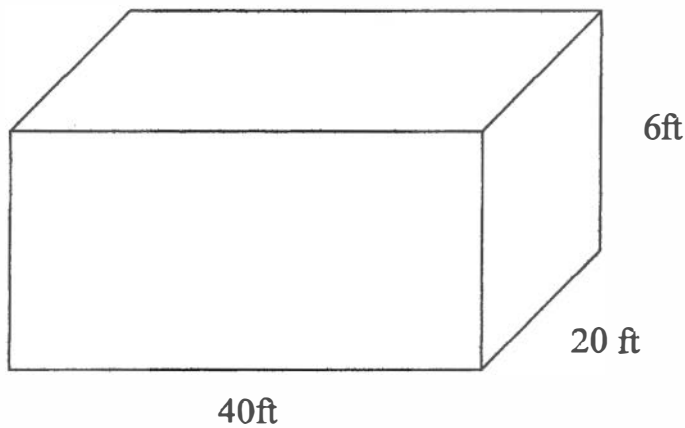
Name _____

Homebase _____

Date _____

Homework 12

Below is a picture of blueprint for an in-ground swimming pool. Answer the following questions about the in-ground pool.



The length of the pool is _____

The width of the pool is _____

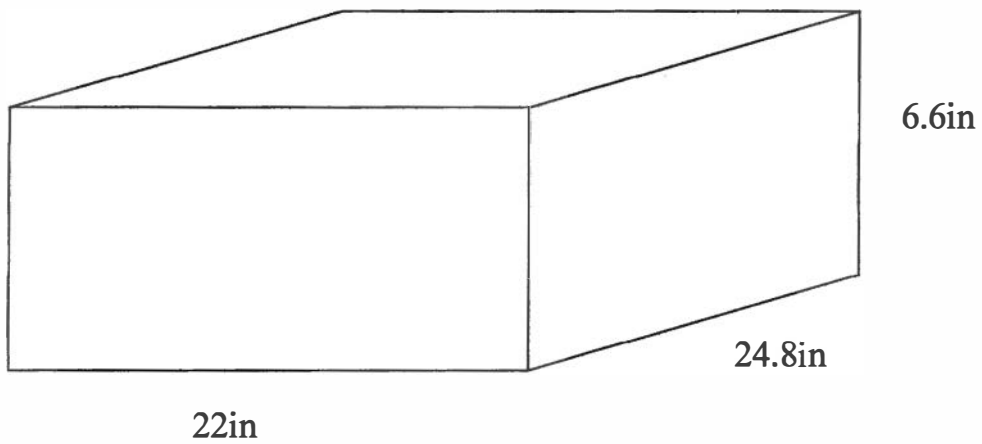
The depth of the prism is _____

The volume of the pool tells us how much water the pool can hold. What is the volume of the pool in cubic feet of water?

Volume = _____ x _____ x _____ = _____ ft^3

Jose' wants to hire someone to put water in his pool. He was told it would cost him \$.20 per cubic inch of water they had to put in the pool. How much would it cost him to fill the pool to the top? Show your work.

Answer _____



What are the three dimensions of the rectangular prism above?

Length = _____

Width = _____

Height = _____

What is the volume of the rectangular prism?

Answer _____

2 Answer the following questions about your chart.

- a. Which rectangular prism has the greatest surface area? Remember, you describe a particular rectangular prism by its three dimensions.

Answer _____

- b. Which of your rectangular prisms has the least surface area?

Answer _____

- c. What is the difference in surface area between the prism with the least surface area and the prism with the greatest surface area?

Answer _____

- d. Sketch the prism with the least surface area, label its dimensions, and describe its characteristics.

Characteristics:

- e. Sketch the prism with the greatest surface area, label its dimensions, and describe its characteristics.

Characteristics:

3. Name 2 major differences between the rectangular prism with the least surface area and the prism with the greatest surface area.

1. _____

2. _____

4. How many rectangular prisms can be formed with 17 inch cubes?

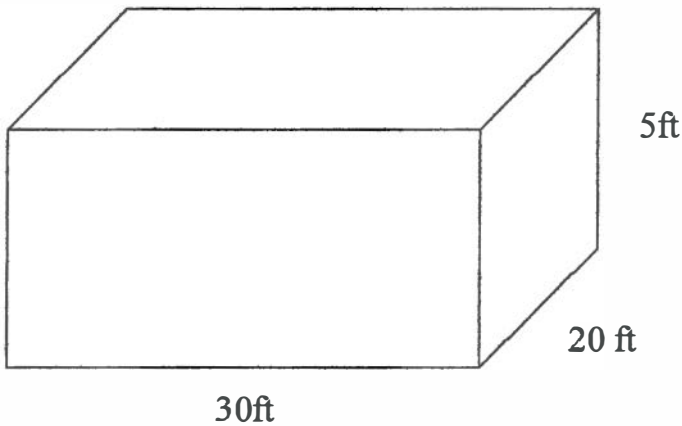
Answer _____

a. What are the dimensions of the prism? _____

b. How do you know that that is the only one? Use the word divisor(s) in your answer. _____

c. What conjecture can you make about all rectangular prisms formed from a prime number of inch cubes?

5. Below is a picture of blueprint for an in-ground swimming pool. Answer the following questions about the in-ground pool.



What are the dimensions of the in-ground pool? _____

The volume of the pool tells us how much water the pool can hold. What is the volume of the pool in cubic feet of water? Show your work.

Volume = _____ ft^3

Marcus wants to hire someone to put water in his pool. He was told it would cost him \$.25 per cubic inch of water they had to put in the pool. How much would it cost him to fill the pool to the top? Show your work.

Answer _____

The Rochester Instructional Framework

Lesson Plan 13

Lesson Topic:

Volume of rectangular prism extended

NYS Learning Standard

Standard 3

Students will work cooperatively on real world problems. During the process they will communicate mathematically and reason mathematically.

Standard 4

Students will apply the scientific concept of surface area and volume pertaining to real physical settings.

Standard 5

Students will apply the technological knowledge of surface area and volume to solve problems. The construction of models may be necessary.

Standard 6

Students will understand the relationship between mathematics and science. The science teacher I work with works with me on connecting the two subjects through surface area and volume.

Standard 7

Students will use what they learn about volume and surface area to answer real life problems.

Key Ideas

Mathematical Reasoning:

Math reasoning is used to solve a real world problem.

Operations:

Operations are used to find volume and used in various parts of the problem-solving process.

Modeling/Multiple Representation:

Models are created by students to help them visualize and solve problems involving volume.

Measurement:

The ability to measure volume is needed as well as other measurements such as: “How much compact trash can fit into a cubic foot of space? How long it will take for the dump site to be filled with garbage?”

LESSON PREPERATION

Objective:

To further the students understanding of volume with real world problems where volume of rectangular prisms play a part

Essential Question:

How do you find the volume of a rectangular prism?

Materials:

- Textbook
- Paper
- Transparencies

WORKSHOP

Bridge: Warm-up

A discussion of where garbage goes.

Where does all of our garbage go?

How many bags of trash do you throw out every day?

How much room does it take up? Etc.

Mini-lesson: teacher directed

- Transparency 13

Transparency 13;

The city of Greendale has set aside a piece of land on which to bury its garbage. The city plans to dig a rectangular hole with a base measuring 500 feet by 200 feet and a depth of 75 feet.

The population of Albion is 100,000. It has been estimated that, on average, a family of four throws away 0.4 cubic foot of compacted garbage a day.

Problem 3.2

- A. How much garbage will this site hold?
- B. How long will it take before the hole is filled?

Mini-lesson: teacher directed

- Guided practice on how to solve the problem.
- Word splash on how we should solve in steps. What should the first step be? Break the problem up into smaller parts. Draw a picture, etc.
- Draw a picture

Work time

Give the students a similar problem to solve. The worksheet will pertain to the Rochester dump site, a real world application that they can relate to.

Summary

Have students offer their solutions. Have a drawing on which group will present to the class their solution.

LEARNING EXTENTIONS

Assessments:

- Ask questions
- Listen in on their group discussions redirecting where necessary
- Look at their work
- Collect group work and judge how well they understand the material

Homework:

A similar problem for homework

Transparency 13

The town of Albion has set aside a piece of land on which to bury its garbage. The town plans to dig a rectangular hole with a base measuring 500 feet by 200 feet and a depth of 75 feet.

From here what question will I most likely ask?

The population of Albion is 100,000. It has been estimated that, on average, a family of four throws away 0.4 cubic foot of compacted garbage a day.

- A. How much garbage will this site hold?
- B. How long will it take before the hole is filled?

Do Part A first!

A. How much garbage will this site hold?

Thoughts:

Answer _____

B. How long will it take before the hole is filled?

Answer _____

Name _____

Homebase _____

Date _____

Group Work 13

The City of Rochester has set aside a piece of land to bury its garbage. The city plans to dig a rectangular hole with a base measuring 600 feet by 300 feet and a depth of 100 feet.

The population of Rochester is 1,000,000. It has been estimated that, on average, a family of four throws away 0.4 cubic foot of compacted garbage a day.

A. How much garbage will this site hold? Show your work.

Answer _____

B. How long will it take before the hole is filled? Show your work.

Answer _____

Name _____

Homebase _____

Date _____

Homework 13

The City of Rochester has set aside a piece of land to bury its garbage. The city plans to dig a rectangular hole with a base measuring 650 feet by 275 feet and a depth of 125 feet.

The population of Rochester is 1,000,000. It has been estimated that, on average, a family of four throws away 0.5 cubic foot of compacted garbage a day.

A. How much garbage will this site hold? Show your work.

Answer _____

B. How long will it take before the hole is filled? Show your work.

Answer _____

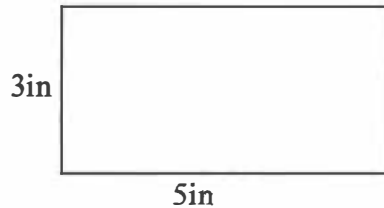
Name _____

Homebase _____

Date _____

Review homework 10

1. Each dimension of the rectangle below is rounded to the nearest inch.



Part A

What is the least length and width the rectangle may actually have? Give each answer to the nearest $\frac{1}{8}$ inch.

Least length: _____ Least width _____

Part B

Using your answer from part A, find the least perimeter the rectangle may actually have.

Least perimeter: _____

2. The volume of a cube is written $V = s^3$, where s is the length of the side of the cube. How does the volume of a cube change when s doubles? (Hint: create some examples)

The volume becomes...

- a. 2 times its original amount
- b. 3 times its original amount
- c. 4 times its original amount
- d. 8 times its original amount

Name _____

Homebase _____

Date _____

Quiz 5

The City of Rochester has set aside a piece of land to bury its garbage. The city plans to dig a rectangular hole with a base measuring 1000 feet by 450 feet and a depth of 225 feet.

The population of Rochester is 1,200,000. It has been estimated that, on average, a family of four throws away 0.5 cubic foot of compacted garbage a day.

A. How much garbage will this site hold? Show your work.

Answer _____

B. How long will it take before the hole is filled? Show your work.

Answer _____

The Rochester Instructional Framework

Lesson Plan 14

Lesson Topic:

Introduction to finding the area of circles

NYS Learning Standard

Standard 3

Students will work in groups estimating the area of circles. They will communicate mathematically as they work on real world problems.

Standard 5

Students will apply the concept of estimation as they find the area of circles by counting unit-squares.

Standard 7

Students will apply their mathematical knowledge to address real life problems that I give them to work on in groups and individually.

Key Ideas

Measurement:

Estimation will be the focus of the lesson, as it is impossible to find the exact measure of the area of a circle. Estimation of the number of unit-squares that are in a circle will be used.

Uncertainly:

Estimation will be used to count the number of unit squares that are in a circle. Rounding will be used as well.

LESSON PREPERATION

Objective:

Students will understand why the formula for finding the area of a circle is $A = \pi * r^2$

Essential Question:

How do you find the area of a circle?

Materials:

- worksheets
- calculators
- Inch and cm grid paper transparencies for the groups to use put over their circles to estimate their area

WORKSHOP

Bridge: Warm-up

How do you find the area of the base of a can of Pepsi? What is area?

Then what is the area of a circle? (the number of unit squares it consists of)

Mini-lesson: teacher directed

- Teach them that the area of a circle is found by counting the number of unit squares invisible.
- Demonstrate how to estimate the number of cm squares in a circle using the cm grid transparency overlay (estimate the area of the base of a can of Pepsi).

Work time

- Have the students estimate the area of circles on a worksheet using the transparencies of cm grid paper.

Mini-lesson:

- Teach the students how to get a closer estimate of the area of any circle by use of the formula $A = \pi r^2$
- Give 2 examples on a transparency

Work time

- Have students work in groups finding the area of various circles given either the radius or the diameter.

Summary

Go over the first few problems just solved in groups.

Have the students continue to work on the worksheet for the remainder of the period.

LEARNING EXTENTIONS

Assessments:

- Several checks for understanding and asking of questions during the lesson
- Assess group discussions
- Assess group work by collecting it
- Assess their further understanding by collecting homework

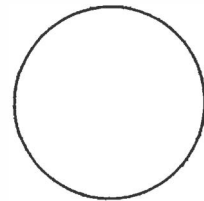
Homework:

Review homework/ hw 14

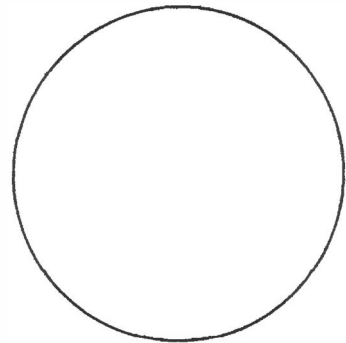
Transparency 14

Estimate the area of the following circles using the transparency of cm grid paper

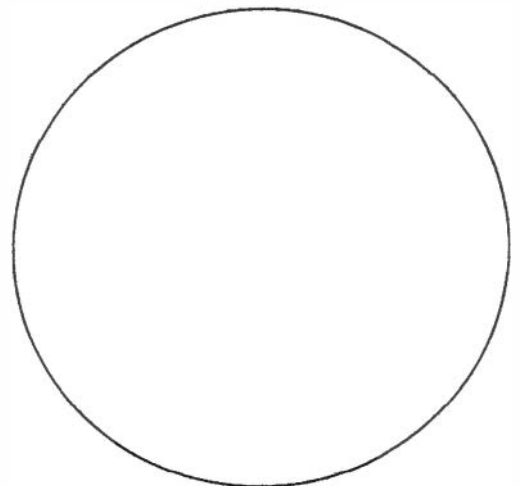
Area is approximately _____ cm^2



Area is approximately _____ cm^2



Area is approximately _____ cm^2



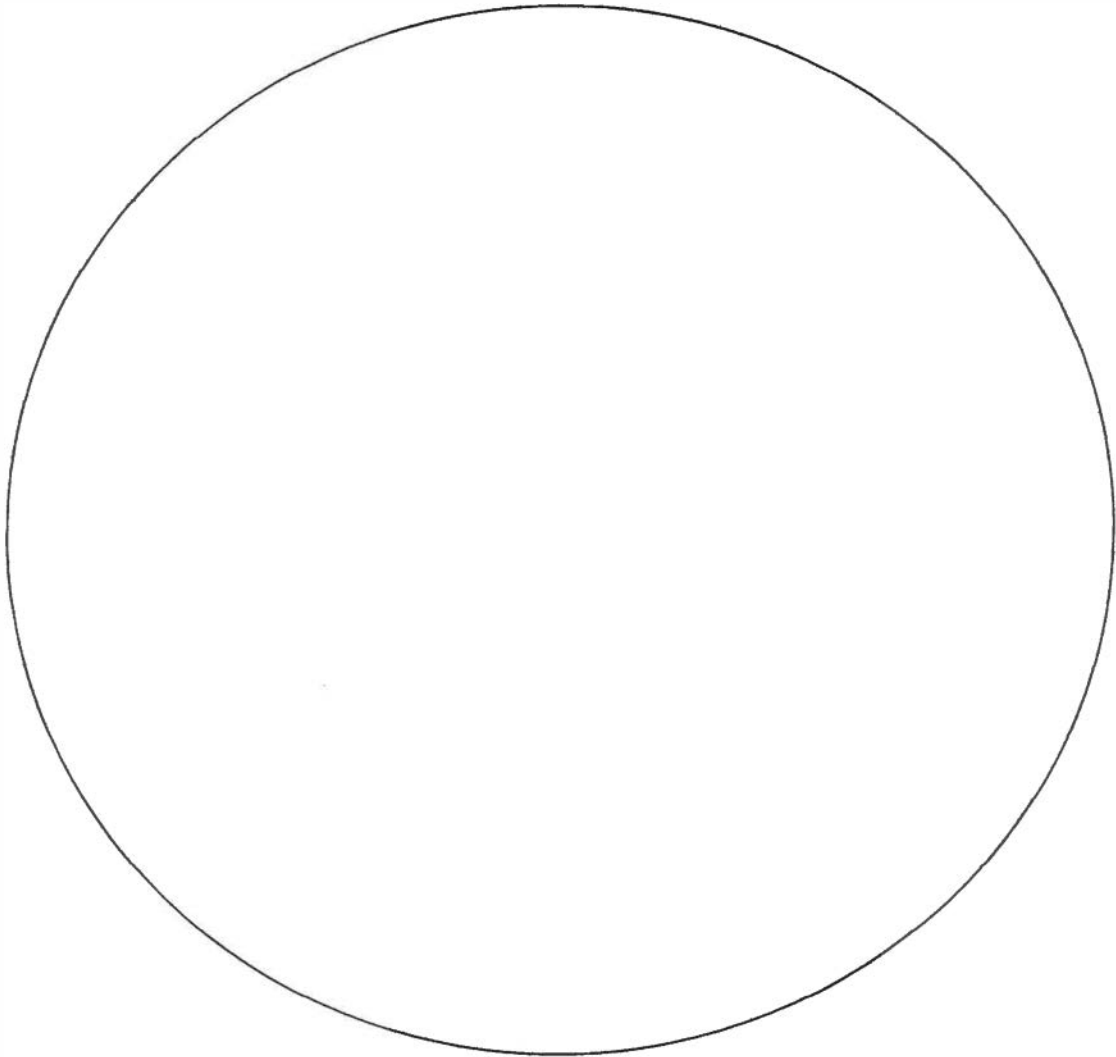
Name _____

Homebase _____

Date _____

Group Work 14

Estimate the area of the following circle 3 liter soda bottle base. Use the cm grid paper transparency and the inch grid-paper transparency.



The area is approximately _____ cm^2

The area is approximately _____ in^2

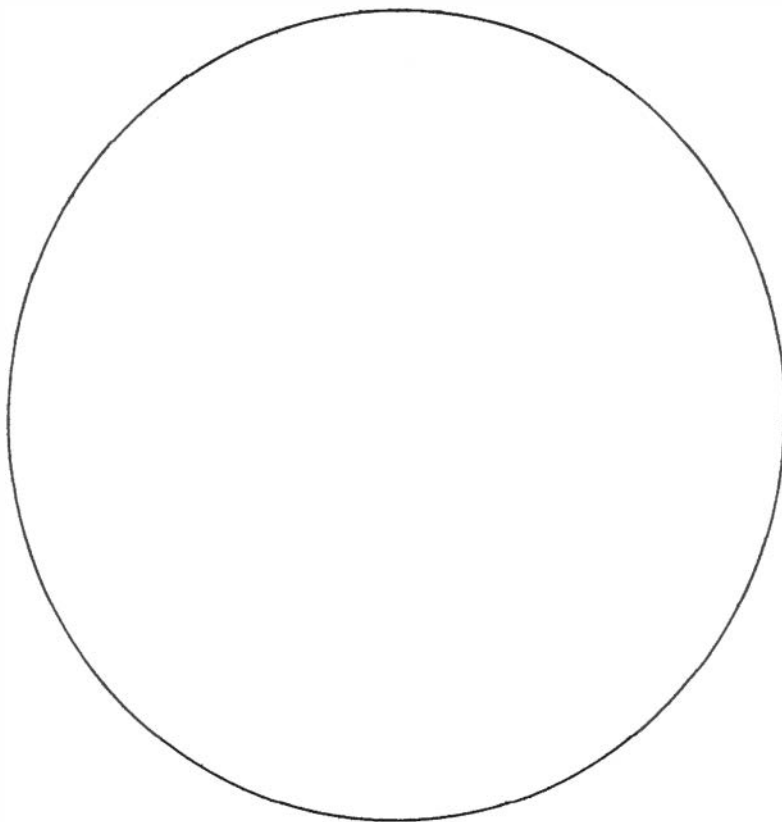
Name _____

Homebase _____

Date _____

Home work 14

Estimate the area of the following circle by cutting it into inch-squares to the best of your ability and approximating the number of inch squares in it.



The area is approximately _____ in²

Name _____

Homebase _____

Date _____

Review Homework 14

1. I intend to tile my kitchen floor. The floor is the shape of a 12ft by 9ft rectangle. Each tile has an area of 1.5ft^2 . How many tiles will I need to cover my entire floor?

Answer _____

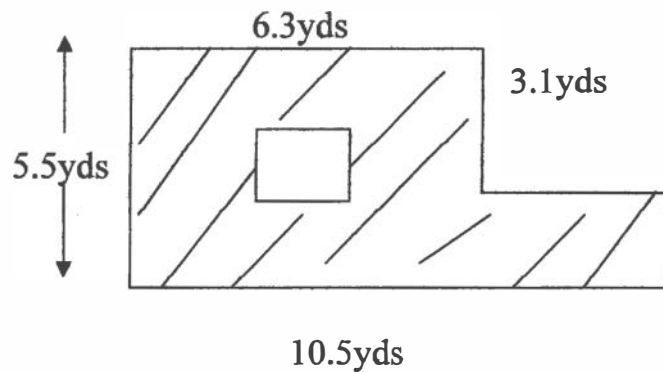
2. The school kitchen floor is 50ft by 40ft. If each tile has an area of 1.5ft^2 , how many tiles are needed to cover the entire floor?

Answer _____

How much would it cost for the tiles, if they cost \$.20 each? Show your work.

Answer _____

3. Find the area of the shaded region lawn area. The rectangle in the center is a 3yd by 3.3 yd rectangle.



What is the area of the shaded region? Show your work.

Answer _____

How much would it cost to cover the whole area with fertilizer, if the fertilizer costs a quarter per square inch of land it covers?

Answer _____

The Rochester Instructional Framework

Lesson Plan 15

Lesson Topic:

Estimating the volume of a cylinder using unit cubes

NYS Learning Standard

Standard 3

Students will work in groups finding the volume of cylinders. They will communicate mathematically about real world problems.

Standard 5

Students will apply the concept of estimation as they find the area of circles by counting unit-squares. They will also apply the technical knowledge of finding the volume of a cylinder.

Standard 7

Students will apply their mathematical knowledge to address real life problems that are given to them to work on in groups and individually.

Key Ideas

Mathematical Reasoning:

It requires math reasoning to understand that when you are finding the volume of a cylinder, you are actually counting the number of unit-cubes will fit inside the prism.

Operations:

The formula for finding the volume of a cylinder requires many operations including multiplication and the use of exponents.

Modeling/Multiple Representation:

Students will use drawings of cylinders to represent real world cylindrical shapes to help them find the volume.

Measurement:

Students will use the formula for finding the volume of a cylinder.

Uncertainly:

Students will understand that whenever 3.14 is used for pi in a formula that their answer is an approximation, for 3.14 itself is an approximation.

LESSON PREPERATION

Objective:

Students will learn or further their understanding that the volume of a rectangular prism can be found by multiplying the area of the base by its height.

The process will be simplified to area of the base times the height so that the same process can be used for cylinders and other prisms.

The students will learn that area of base \times height can be used to find the volume of a cylinder as well

Essential Question:

How do you determine how many unit cubes will fit in a cylinder?

Materials:

- Cm grid paper
- Paper cylinders on grid paper
- Markers
- Worksheet
- Transparency

WORKSHOP

Bridge: Warm-up

- Find the area of the following circle
- How much cubic inches of soda does a 12 ounce can of soda hold?
- Give the dimensions of the can.

The can is 5 inches tall and the diameter of the top of the can is 2.5 inches.

Mini-lesson: teacher directed

- Review how to find the area of a circle, or the bottom of a cylinder, or can. Area
 $= \pi r^2$

Work time

- Worksheet on finding the area of a circle.

Summary

Go over the worksheet on finding the area of a circle using the formula

Mini-lesson

- Volume = Area of the base * the height
- In the case of a rectangular prism, it so happens that the base is a rectangle and the area of a rectangle is found by multiplying length times width.
- Introduce a cylinder by raising a can of Coke.
- Word splash of what defining features make it recognizable as a cylinder
- How many cubes will fit in it?

- Introduce:

Volume of a cylinder = Area of the base x the height

Volume of a cylinder = $\pi r^2 \times h$

- Find the volume of the can of Pepsi before the students. It can be used as a guided practice as they discover the volume with me.

Work time

- Give the students a worksheet with various real world cylinders and their dimensions for them to find the volume of.

Summary

Have one of the groups demonstrate how they found the volumes of the various cylinder shaped cans.

LEARNING EXTENTIONS

Assessments:

- Use of questioning techniques
- Sit in on various groups' discussions

- Go over the group work at the end of class
- Assessing their homework

Homework:

Worksheet on finding the area of circles and the volume of cylinders by using the two formulas

Name _____

Homebase _____

Date _____

Group Work 15

Answer the following questions about circles that appear in the world.

1. What is the area of a dart board with a diameter of 20 inches?

Answer _____

2. What is the area of the clock faces in all the rooms in the building?

The diameter of one face is 13 inches.

Answer _____

3. What is the area of the head of a piece of chalk that has never been used if the diameter of the tip is .5 inches?

Answer _____

4. What is the area of the face of a Presidential Rolex that has a radius of 1.25 inches?

Answer _____

5. What is the area of the circle in the middle of an NBA basketball court given that the radius of the circle is 6ft?

Answer _____

6. What is the area of the circle in the middle of a soccer field, given that the radius of the circle is 10 yards?

Answer _____

7. What is the area of the circle in the middle of a hockey rink that has a diameter of 30 feet?

Answer _____

Name _____

Homebase _____

Date _____

Homework 15

Answer the following questions about circles that appear in the world.

1. What is the area of a circle with a radius of 2.3 in?

Answer _____

2. What is the area with a diameter of 9.6in?

Answer _____

3. What is the area of a circle with a radius length of 7in?

Answer _____

4. Find the volume of a cylinder that has a height of 30mm and a base that has a diameter of 12mm.

Answer _____

5. Find the volume of a cylinder that has a height of 25inches and a base that has a diameter of 21 inches.

Answer _____

6. What is the volume of a cylinder that has a height of 12 ft and a radius of $3\frac{1}{4}$ ft?

Answer _____

The Rochester Instructional Framework

Lesson Plan Outline 16

Lesson Topic:

volume of cylinders

NYS Learning Standard

- Same as the previous lesson
- Uncertainty will be a greater part of this lesson as rounding to specific place values will be involved.

LESSON PREPERATION

Objective:

- students will better understand that the volume of a cylinder is found by the same way it is for a rectangular prism: $\text{volume} = \text{area of the base} * \text{the height of the prism}$
- a review of rounding
- students will learn the general formula for finding the volume of any cylinder
- abstract the process for finding the volume of a cylinder

Essential Question:

How do you find the volume of a cylinder?

Materials:

Worksheets for group work

Worksheets for homework

WORKSHOP

Bridge: Warm-up

- Calculations of square numbers
- Find the area of the following circles. Round your answer to the nearest hundredths place.

Mini-lesson: teacher directed

- Review of how to find the volume of a cylinder
- Review that the volume of a cylinder can be found by the same process as for finding the volume of a rectangular prism, $v = \text{area of the base} * \text{Height}$
- Volume = the area of the circular base * the height of the cylinder
- Volume = $\pi r^2 * H$

Work time

Students will work in groups finding the volume of various cylinders. Rounding will be a big part of this lesson.

Summary

Go over the group work solutions.

LEARNING EXTENTIONS

Assessments:

Ongoing throughout the lesson

How do you know the students have acquired learning?

Homework:

Worksheet on the volume of cylinders, the area of circles, and rounding

Name _____

Homebase _____

Date _____

Group Work 16

1. What is the volume of a cylindrical soup can that has a radius of 2.3 inches and a height of 5 inches? Show your work.

Answer _____

2. What is the volume of a can of tennis balls that has a diameter of 3 inches and a height of 9.5 inches? Show your work.

Answer _____

3. What is the volume of a can of paint that has a circular base with a radius length of 4 inches and has a height of 8 inches? Show your work.

Answer _____

Name _____

Homebase _____

Date _____

Homework 16

1. What is the volume of a cylindrical soup can that has a radius of 3 inches and a height of 4.5 inches? Show your work.

Answer _____

2. What is the volume of a can of racquet balls that has a diameter of 2 inches and a height of 5.5 inches? Show your work.

Answer _____

3. What is the volume of a can of paint that has a circular base with a radius length of 3.5 inches and has a height of 7 inches? Show your work.

Answer _____

Name _____

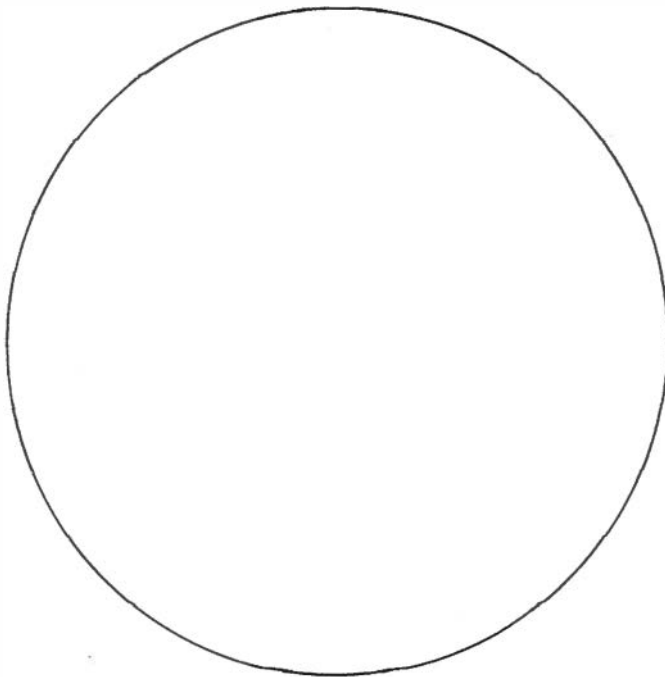
Homebase _____

Date _____

Quiz 6

1. Below is the base of a can of spray paint. The diameter of the circle is 2.8 inches.

Estimate the area of the circle by using the formula, $\text{Area} = \pi r^2$.



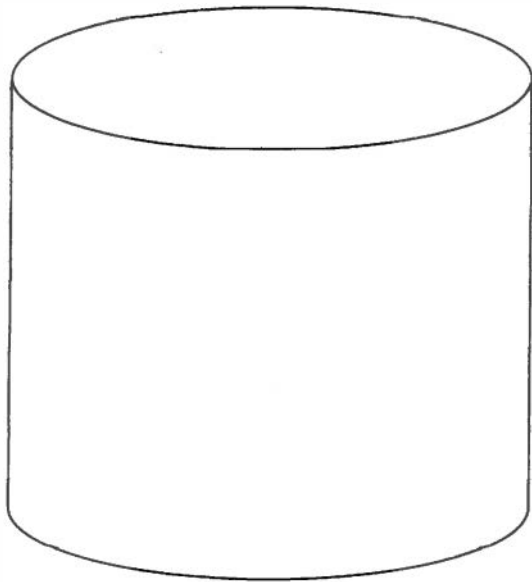
Answer _____

2. Find the volume of the can of spray paint if the height of the cylinder is 10 inches.

Use the formula $\text{Volume} = \pi r^2 H$
Be sure to show your work.

Answer _____

3. What is the volume of the following cylinder, given that the height of the cylinder is 7 cm and the diameter of its base is 6 cm?



Answer _____

Name _____

Homebase _____

Date _____

Building a fish tank

Directions: Show your work.

1. A rectangular box shaped fish tank has a length of 2 feet, a width of 10 inches and a height of 1 foot. The directions state that when you put fish in the tank you can only have .005 fish per cubic inch of water in the tank. Based on the directions, what is the maximum number of fish the tank can hold? Show your work.

Answer _____

b. A glass fish tank is made of 5 sheets of rectangular glass. If I wanted to make the fish tank described above, how many square inches of glass will I need? Show your work.

Answer _____

c. If the glass costs a penny per square inch, how much would it cost for the glass to make the fish tank?

Answer _____

d. A fish tank is incomplete without a few other things. Tyrone needs to buy fish, colorful rocks, an electric filter, glue, a piece of metal frame to go around the perimeter of the top of the fish tank, and a frog.

The fish cost \$1.25 each. A bag of colorful rocks costs \$2.50. An electric filter costs \$10.25. The glue costs \$3.99. The metal frame material costs \$.10 per inch. And the frogs cost \$2.99 each.

How much would it cost to make the tank and furnish it the maximum number of fish and one frog? Don't forget to include the 8.25% New York State sales tax.

Also remember to include the cost of the glass in the total price of making the fish tank.

Answer _____

Name _____

Homebase _____

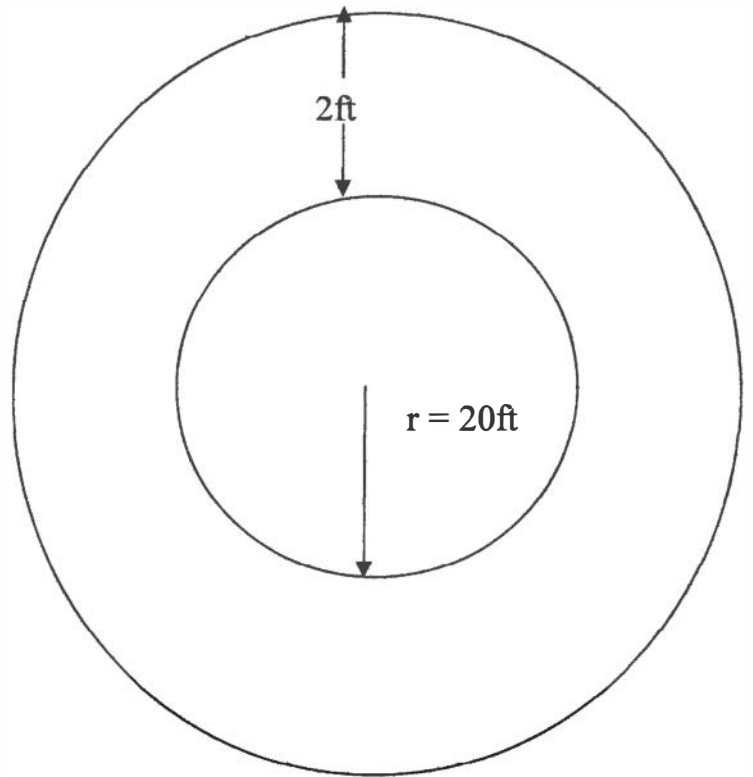
Date _____

Review Worksheet 16

1. The YMCA is putting a walkway around a circular wading pool. The walkway will be 2 feet wide. A diagram of the pool and walkway is shown. (use $\pi = 3.14$)

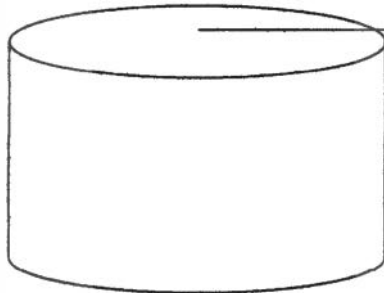
What is the circumference of the outside of the walkway?

- a. 69.08 feet
- b. 94.32 feet
- c. 138.16 feet
- d. 1,519.76 feet



Which expression represents the volume of the cylinder?

$$r = 6\text{cm}$$



$$h = 20\text{ cm}$$

Recall, Volume = πr^2H

Show your work.

a. 12π

b. 36π

c. 240π

d. 720π

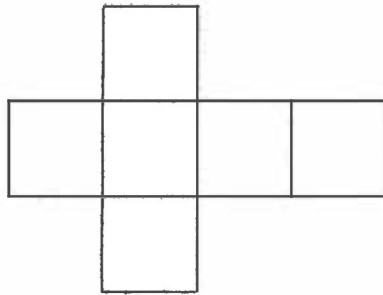
Name _____

Homebase _____

Date _____

Unit Test

1. Find the area and perimeter of the following polygon constructed from .5in by .5in squares. Be sure to show your work.



Area = _____ in²

Perimeter = _____ in

2. What is the area of a boxing ring that is 16ft by 16ft? Show your work.

Answer _____

3. A boxing ring is the shape of a square and has to have an area between 256 ft^2 and 441 ft^2 .

- a. What is the minimum perimeter of the boxing ring? Show your work.

Answer _____

- b. What is the maximum perimeter of a boxing ring? Show your work.

Answer _____

- c. The canvas floor of the boxing ring needs to be replaced. If the canvas costs \$2 per square foot, how much would it cost to cover the 16 ft by 16ft boxing ring?

Answer _____

4. A toy company wants to arrange 44 blocks in the shape of a rectangular prism and then package them in a box that fits the prism, exactly.
- A. Find all the ways 44 cubes can be arranged into a rectangular prism. Make a sketch of each arrangement you find and give its dimensions and surface area. It may help to organize your findings into a table with a column for length, width, height, volume, and surface area.

- B. Which of your arrangements requires the least material to make the box? Explain how you got your answer.

Answer _____

Explanation:

- C. Which of the arrangements requires the most material to make the box? Explain your answer.

Answer _____

Explanation:

5. The dimensions of the recreation center floor are 150ft by 50ft by 400ft, and the walls are 9ft. A gallon of paint will cover 400ft^2 . About how much paint is needed to paint the walls of the recreation center.

Answer _____

6. Sketch a rectangular prism that is 6in by 6in by 6in and a cylinder that has a height of 6in and has a diameter of 6in.

a. Which one has the greater volume? Show how you found your answer.

b. Which of the shapes has the greater surface area? How much greater? Show how you found your answer.

7. There are two cans of soda that Wegman's sells. The smaller can of soda is shaped like a cylinder. It has a radius of 3cm and a height of 12.5 cm. The party-size can has a radius of 18cm and a height of 37.5cm.

a. How many square centimeters of aluminum are needed to make the smaller can? Show your work.

Answer _____

- b. How many square centimeters of aluminum are needed to make the party-size can? Show your work.

Answer _____

- c. How many cubic centimeters of cola will the smaller can hold?

Answer _____

- d. How many cubic centimeters of cola will the party-size can hold?

Answer _____

8. Loew's Theatre concession sells two sizes of popcorn: a kid's size and a jumbo box. The kid's box of popcorn is shaped like a rectangular prism with a length of 4in, width of 2in, and a height of 6in. The jumbo box has the following dimensions: 8in length, 4in width, and 12in height.

a. About how many square inches of cardboard are need to make the kid box?

Answer _____

b. About how many square inches of cardboard are needed to make the jumbo box?

Answer _____

c. How many cubic inches of popcorn will fit in the micro box if the top of the popcorn is level with the top of the box?

Answer _____

- d. How many cubic inches of popcorn will fit in the jumbo box if the box is filled to the top?

Answer _____

- e. If the smaller box sells for 75 cents, what should the price of the jumbo box be if the price is based on the amount of popcorn the box holds?

Answer _____

BONUS

Directions: Show your work.

1. A rectangular box shaped fish tank has a length of 2 feet, a width of 10 inches and a height of 1 foot. The directions state that when you put fish in the tank you can only have .005 fish per cubic inch of water in the tank. Based on the directions, what is the maximum number of fish the tank can hold? Show your work.

Answer _____

b. A glass fish tank is made of 5 sheets of rectangular glass. If I wanted to make the fish tank described above, how many square inches of glass will I need? Show your work.

Answer _____

c. If the glass costs a penny per square inch, how much would it cost for the glass to make the fish tank?

Answer _____

d. A fish tank is incomplete without a few other things. Tyrone needs to buy fish, colorful rocks, an electric filter, glue, a piece of metal frame to go around the perimeter of the top of the fish tank, and a frog.

The fish cost \$1.25 each. A bag of colorful rocks costs \$2.50. An electric filter costs \$10.25. The glue costs \$3.99. The metal frame material costs \$.10 per inch and the frogs cost 2.99 each.

How much would it cost to make the tank, and fill it with maximum number of fish and one frog? Don't forget to include the 8.25% New York State sales tax.

Also remember to include the cost of the glass in the total price of making the fish tank.

Answer _____