Grade 9 Math

Student Resource

Complete this package to become a more successful test taker.

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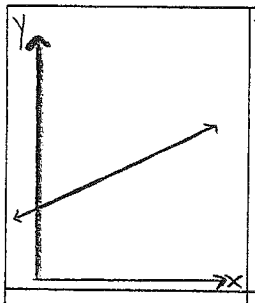
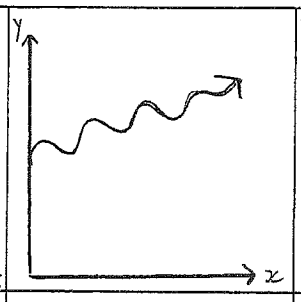
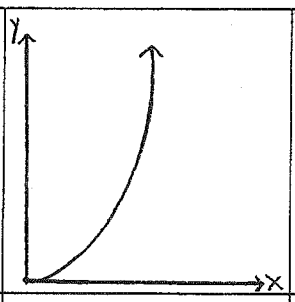
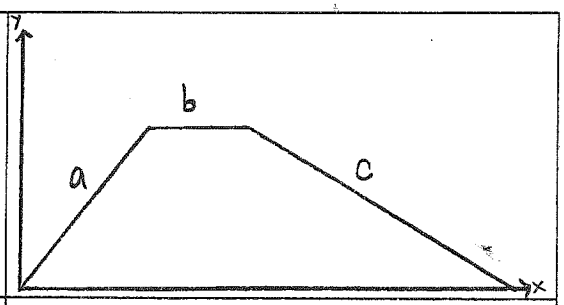
Session #1 - *What are they even asking?*

Sometimes the difficulty in answering a question happens not because we can't do the math but because we don't understand the words they are using or what the question is asking us to find.

Here is some key terminology to remember:

1. **Constant Rate**
   - When something is described as having a "constant rate" the question is telling you the relationship is linear.
   - In a distance-time graph, something is moving at a constant rate if the speed is the same for the entire graph (one single straight line).

			
Constant Rate	Not a Constant Rate	Not a Constant Rate	Although each section of the graph has a constant rate, the entire graph can't be represented by a single straight line and therefore does not represent a constant rate of change.

2. **Rate of change**
   - Also known as; $\frac{rise}{run}$, $\frac{change\ in\ y\ values}{change\ in\ x\ values}$, slope, steepness of a line, speed, m.
   - Rate of change is the change in your y-values over the change in your x-values to get from one point on your line to any other point on your line.

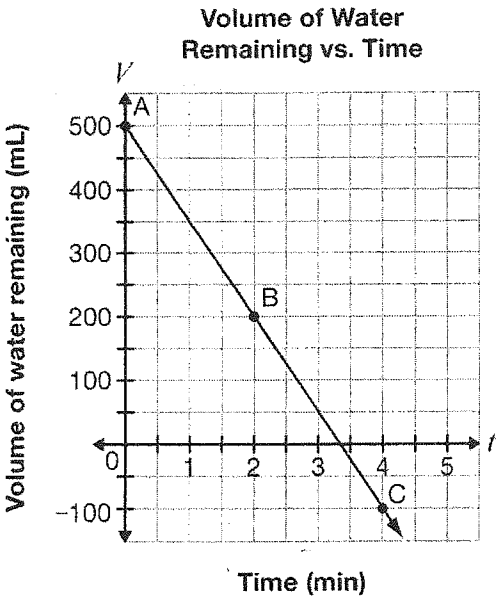
3. **Steeper**
   - If a line is steeper then another line, it has a greater absolute slope.
   - The closer a line is to being vertical the steeper it is.

4. **Equation of a line**
   - $y = mx + b$
   - m is the slope
   - b is the y-intercept. (the value when x = 0, which is where your line touches the y-axis)
   - The y-intercept is also known as; initial value, fixed fee, flat amount.

5. **Equivalent**
   - Things are equivalent if they have the same meaning.
   - $\frac{2}{4}$ is equivalent to $\frac{1}{2}$ because they both equal 0.5.

1. Drippy Drops

Water is leaking from a bottle at a constant rate. Julia draws the line on the graph below to model the relationship between the volume of water remaining and time.



Ask yourself:

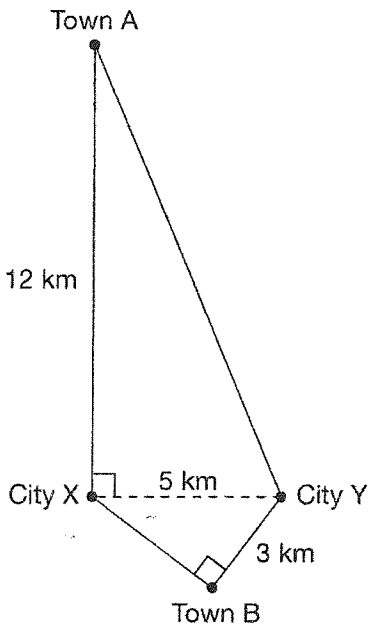
1. What is the question asking you to do?
2. What does it mean if water is "leaking" from a bottle?
3. What are they trying to tell us when they say "leaking at a constant rate?"
4. Would you expect the line showing the relationship between volume of water remaining and time to be going up and to the right or down and to the right?
5. Examine the given graph (read and interpret the title, labels of both the x and y axis and the scale of the x and y axis)
6. Consider (write out) the coordinates for point A, B, and C from the given graph. Remember points are written (x, y), so, in this question the points are (time, volume).
7. Have you answered the question?

Determine whether each of the 3 points shown on the line is possible in this situation.
Write an interpretation of the meaning of each point.

Point	Is this point possible?	Interpretation
A	**Circle one:** Yes No	
B	**Circle one:** Yes No	
C	**Circle one:** Yes No	

2. Detour

The 5 km of highway between City X and City Y is closed. There are two possible detour routes: one through Town A and one through Town B, as shown in the diagram below.



Ask yourself:

1. What is the question asking you to find?
2. What is a detour?
3. What shapes do you see in the diagram provided?
4. What do you know about the shapes in the diagram?

How does that help you answer this question?

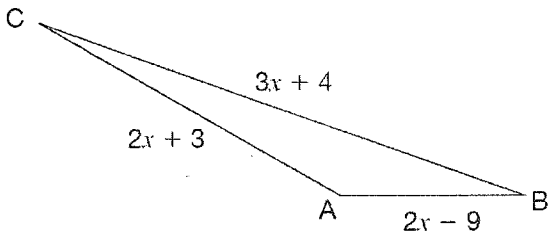
5. Have you answered the question?

How much shorter is the detour through Town B than the detour through Town A?

3. Three partners, Luc, Deborah and Melanie, share the profits of a business in the ratio of 2:3:7 respectively. The profit for this year is $176 496.
Determine the share of the profit for each partner.
Show your work.

4. **What Side?**

The perimeter of the triangle below is 75 m.



Determine the measure of each side of the triangle.

Show your work.

Session #2 – Multiple Choice Questions

Strategies on how to answer multiple choice questions

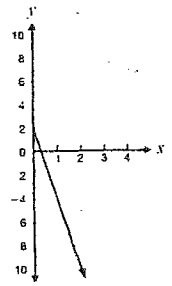
How to start a question:

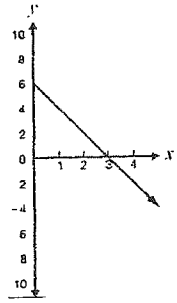
1. Always read the entire question carefully.
2. Highlight or underline any important parts of the question.
3. Look for any diagrams, tables, graphs, or any extra information that may help you understand/answer the question.
4. Decide what the question is asking you to find.
5. Write down any equations that you think may be helpful.
6. Draw any diagrams that you think may be helpful.

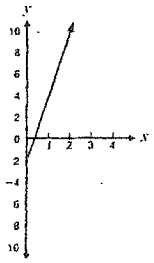
Strategy #1 - *Elimination*

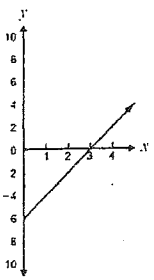
- Rule out any impossible answers if you can.

Ex: Which of the following is the graph of the equation: $y = -2x + 6$?

a) 

b) 

c) 

d) 

What do you notice about the equation?

- The slope is negative ∴ your line should be going down and to the right.

Knowing this, can you rule out any of the possible answers?

- Answers c and d both show lines that are going up and to the right therefor they can't be correct. Cross them out.

Now you have only two possible answers. If you are stuck, you have a 50% chance of guessing correctly (but lets try to avoid guessing if possible).

What else do we know about the equation of a line?

- The "b" value in our equation ($y = mx + b$) represents our y-intercept. This is the point where our line touches/crosses the y-axis.
- In answer "a" the line is shown touching the y-axis at 2. So this can't be the correct answer. Cross it out.
- "b" is the only option remaining. It is going down and to the right and has a y-intercept of 6. ∴ b is the correct answer.

Strategy #2 – *Trial and Error*

- If you are uncomfortable with a certain skill, or, want to check your answer try using Trial and Error.

Ex. . Which value of x satisfies the equation $5 - 2x = 9$?

a) $x = -7$
b) $x = -2$
c) $x = 2$
d) $x = 3$

Check answer "a" $x = -7$ by substituting it back into the equation.

$$5 - 2(-7) = 9$$
$$5 + 14 = 9$$
$$19 = 9$$

This is not true ∴ answer "a" is incorrect. Cross it out.

Check answer "b" $x = -2$ by substituting it back into the equation.

$$5 - 2(-2) = 9$$
$$5 + 4 = 9$$
$$9 = 9$$

This is true ∴ answer "b" is correct.

You can stop there since you found the correct answer.

If you have time test all the remaining options to confirm you are correct or keep going until you find the right answer.

Strategy #3 – *Solve the problem*

- If you can't rule out all the wrong answers then solve the question on your own and see if your answer is listed as a possibility.

Ex. Which value of x satisfies the equation $5 - 2x = 9$?

a) $x = -7$
b) $x = -2$
c) $x = 2$
d) $x = 3$

This question is hard to eliminate any obvious wrong answers without starting to solve the problem.

So, lets solve it.

- Use your inverse operations (opposite operations) to rearrange this question in order to isolate (solve) for x.

$$-2x = 9 - 5$$
$$-2x = 4$$
$$x = \frac{4}{-2}$$
$$x = -2$$

∴ "b" is the answer.

Now you try:

1. A restaurant charges $3 for a cheese pizza plus $2 per additional topping.
   Which of the following shows two models that represent the relationship between the total cost of a pizza, C and the number of additional toppings on it, n?

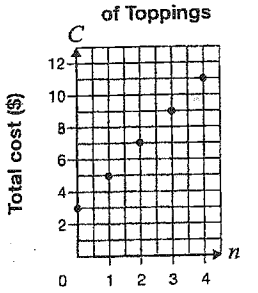
When this question says "shows two models" that means that if "a" is the answer both the table and the graph shown in option "a" must be correct.

- Think about how much it would cost you to order a pizza with zero toppings.
- That number is your initial value, the "b" in your equation.
- Cross out any models and therefore answers that do not have the correct y-int.
- Next, determine your rate of change (slope). How much it costs per topping.
- Rule out any remaining options that have a different slope.
- Whichever option is left should be your answer.

a

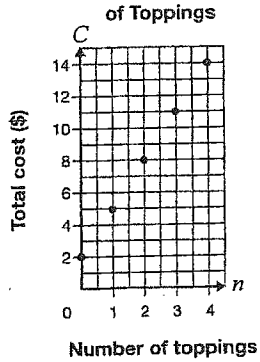
Number of toppings, n	Total cost, C ($)
0	3
2	7
4	11
6	15

Total Cost vs. Number of Toppings



b $C = 3n + 2$

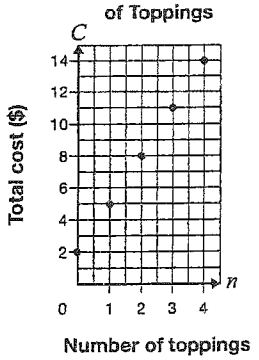
Total Cost vs. Number of Toppings



c

Number of toppings, n	Total cost, C ($)
0	2
2	8
4	14
6	20

Total Cost vs. Number of Toppings



d $C = 2n + 3$

Number of toppings, n	Total cost, C ($)
0	2
1	5
2	8
3	11

2. Consider the following equation:

$$c^2 = 6^2 + 10^2$$

Which is closest to the value of c?

a) 4
b) 6
c) 12
d) 16

3. What value of x makes the equation $4x - 5 = -6x + 15$ true?

a) 2
b) 1
c) -5
d) -10

4. Ella wants a rectangle with

- A perimeter of 100 cm and
- The largest possible area.

What are the dimensions of the rectangle that satisfies her conditions?

a) $10\ cm \times 10\ cm$
b) $20\ cm \times 30\ cm$
c) $25\ cm \times 25\ cm$
d) $40\ cm \times 40\ cm$

Session #3 – Multiple Choice Questions

They aren't just about knowledge and understanding.

Some Multiple Choice questions are meant to assess **application** and **thinking** when it comes to mathematical concepts. This means they usually take a few steps to solve or combine different concepts learnt in class.

How to answer these questions:

1. Approach them at first as you would any other multiple choice question by:
    a) Reading the entire question carefully
    b) Deciding what you are being asked to find.
    c) Looking for any diagrams, tables, graphs or any extra information that may help you.
    d) Ruling out any impossible answers.

If this is an "application" or "thinking" question you probably won't be able to eliminate any possible answers.

2. Use any space on the page (or scrap paper) to write down and show your work.
   Even though your work won't be marked this style of question is too long or complicated to try to do in your head.
3. Write down what you are trying to find. Keep referring to this to keep you on the right track.
4. Write down the information the question has given you.
5. Try to connect the information you are given with what you are being asked to find. Do you know an equation/formula that might be helpful?
6. Answer the question on your own and compare your results with the options given.
7. If it is possible, and you have time, check your answer.

Ex – Last week, Tenisha paid $65.72 for 62 kg of potatoes for her restaurant.

Today, the price of potatoes is $0.02/kg lower.

How much will Tenisha pay for 50 kg of potatoes today?

a $46

b $47

c $52

d $53

ratio → $:kg

65.72 : 62

Solve for the unit rate:

65.72 : 62 = X : 1

$\frac{65.72}{62} = \frac{X}{1}$

X = $1.06/kg

New price:

1.06 − 0.02 = $1.04/kg ×50kg

Ask Yourself:

What are they asking me to find?

- The current price for 50kg of potatoes.

What information has the question given you?

- Last weeks price for 62kg of potatoes. ($65.72)
- The price decrease per kg of potatoes. ($-0.02)

What mathematical concepts are you given or need to use?

How do you know?

- $65.72 for 62kg is a ratio comparing $:kg
- We need to determine the unit rate (how much it costs per one kg of potatoes ($: 1kg)
- We know we need to do this because the price decrease is $0.02 per 1 kg of potatoes.

Solve. (see the hand written notes)

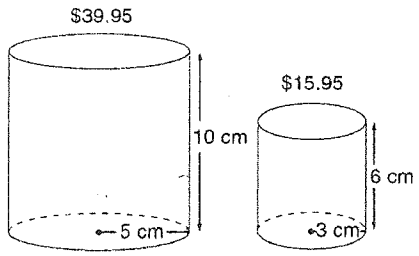
Now you try:

1. There is a linear relationship between the total cost of renting a costume and the number of hours the costume is rented.
   - For 3 hours, the total cost is $60.
   - For 5 hours, the total cost is $80.

   What type of variation is this relationship, and what is its initial value?

   a. A partial variation with an initial value of $30.
   b. A partial variation with an initial value of $20.
   c. A direct variation with an initial value of $30.
   d. A direct variation with an initial value of $20.

2. Two different stores sell coffee in cylindrical packages. The prices and dimensions of the packages from the two stores are shown below.



   Which is closest to the difference between the unit prices of these two packages?

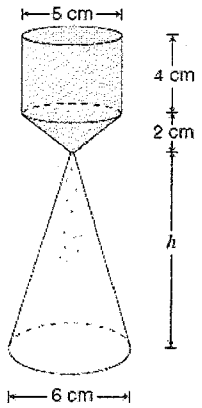
   a $0.04/cm^3

   b $0.05/cm^3

   c $0.09/cm^3

   d $0.24/cm^3

3. Sand is being poured from one container to another, as shown below. The sand flows from the shaded part to the unshaded cone.



   The shaded part starts full of sand. The sand empties into the unshaded cone and fills it to the top. What is the height of the unshaded cone?

   F 6.0 cm

   G 8.3 cm

   H 9.7 cm

   J 12.5 cm

Session #4 – Open Response Questions

Strategies on how to answer Open Response Questions

When answering open response questions use the following process:

What are you being asked you to find

Read the problem enough times so that you can:

- Determine Underline or highlight what information:
  - ✓ Is relevant (what information do they give you that's important to solve the problem)
  - ✓ Is irrelevant (what information do they give you that's unnecessary)
  - ✓ Needs modifying (Changing units, changing diameter to radius...)

Express the problem in a Logical Way

Think about what this question reminds you of:

- ✓ Questions and strategies from recent classes/homework/assignments
- ✓ A related life experience
- ✓ Something you've learnt in another class that will help you here

Write down:

- An equation to represent the problem
- Define any variables you may be using
- Replace your variables (letters) with any given numbers and see what you are missing
- Ask yourself – do I need another formula to answer the question?

Solve the Problem

Consider:

- ✓ What the answer should look like
- ✓ If there is another way to solve this problem
- ✓ Which strategy is best to answer this question and why.

Make sure to:

- Organize your work and do one step at a time
- Use good form
- Solve the problem

Answer the Question

Consider:

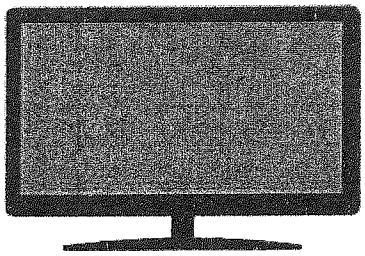
- ✓ Have you reread the question and made sure your answer is logical
- ✓ Have you solved for what the question was asking you to find
- ✓ Have you compared your answer to your anticipated answer
- ✓ If you have time, solve the question again using another strategy to confirm your answer
- ✓ Have you checked your answer by substituting it into an equation, if possible

Write down:

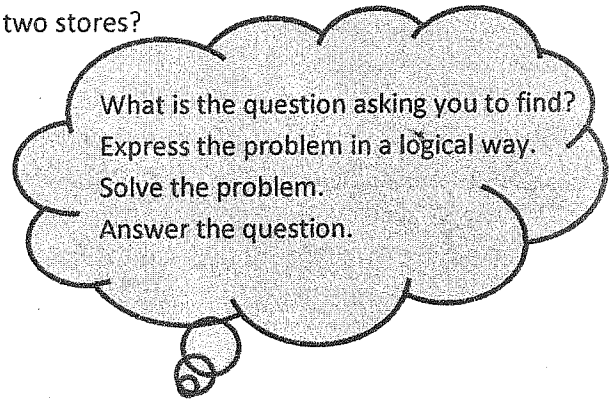
- A concluding statement answering the question. Make sure you include units.

Now you try:

1. Sam is interested in buying a TV. At Fair Deal, the TV is regularly priced at $599.99 and is on sale for 20% off the regular price. At Big Big Discount, the same TV is regularly priced at $899.99 and is on sale for 30% off the regular price.

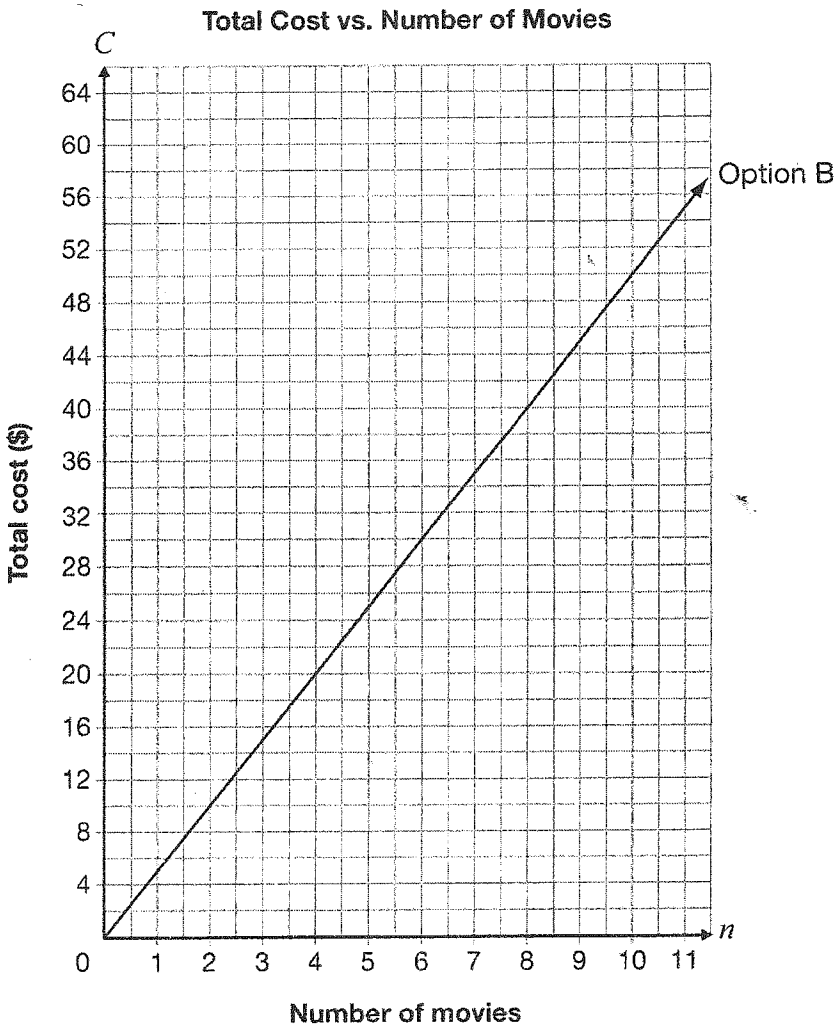


What is the difference in the sale price of the TV between these two stores?



2. There are two payment options for downloading movies from a Web site.

- Option A: Pay $30 for a membership and $2 per movie downloaded.
- Option B: Shown on the grid below.

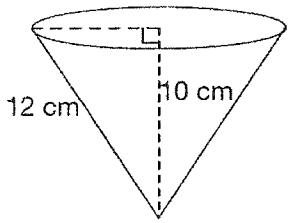


Determine under which conditions a person should select Option A and under which conditions a person should select Option B.

Justify your answer.

3. **Cone Zone**

Zach measures the slant height of a cone-shaped cup and finds that it is 12 cm. The height is 10 cm.



Determine the volume of water in the cup if Zach fills it to the top.

Show your work.

Session #5 – Open Response Questions

There's more than one way to solve a problem

Some key things to know about answering open response questions:

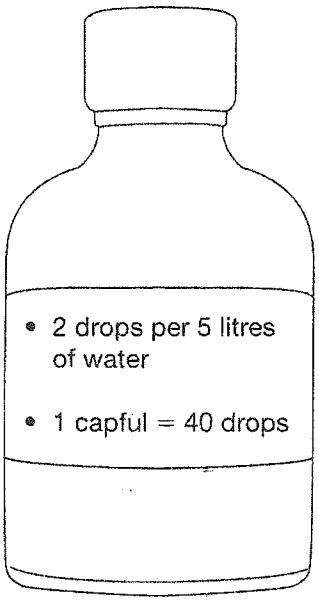
- NEVER leave a question blank.
- Use the space provided to show your work or explain your answer.
- Read the question carefully. Sometimes they give graphs or tables that you can use if you want but don't necessarily have to.
- It's not about the answer. It's about how you try to answer the question, so, make sure your work is as clear as possible and well organized.

The following is a generic model of how EQAO Open Response questions are scored:

Score	What you need to do to get this mark:
0	• Blank: nothing written or drawn in response to the question • Illegible: cannot be read, completely crossed out or erased, not written in English • Irrelevant content: does not attempt assigned question (comment on the task, drawings, "?", "I don't know") • Off topic: no relationship between the written work and the question
10	Attempt the question Application of the knowledge and skills to determine the answer with limited effectiveness due to: • Misunderstanding of concepts • Incorrect selection or misuse of procedures
20	Just the correct answer was given with no work Application of the knowledge and skills to determine the answer with some effectiveness due to: • Partial understanding of the concepts • Errors and/or omissions in the application of the procedures
30	Application of the knowledge and skills to determine the answer with considerable effectiveness due to: • An understanding of most of the concepts • Minor errors and/or omissions in the application of the procedures
40	Application of the knowledge and skills to determine the answer with a high degree of effectiveness due to: • A thorough understanding of the concepts • An accurate application of the procedures (any minor errors and/or omissions do not detract from the demonstration of a thorough understanding)

Now you try:

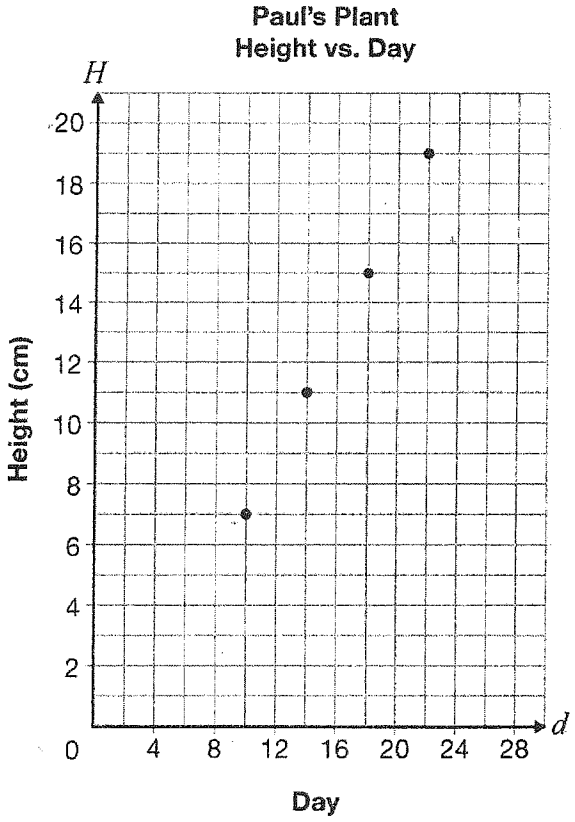
1. James adds vitamin drops to his fish tank to keep his fish healthy.
   If James follows the instructions on the bottle of vitamins,
   how many capfuls should he add to his 350-litre fish tank?
   Show your work.



2. Lucia and Paul each have a plant. Both plants grow at a constant rate. Lucia records information about the height of her plant in a table, and Paul graphs his results as shown below.

Lucia's Plant

Day	Height (cm)
4	8
7	10
10	12
13	14



Whose plant is growing faster?

Circle one: Lucia's Paul's

Justify your answer.

Below expectations – Grade 9 Applied

A review of questions that tripped us up last year so that we don't make the same mistakes again.

1 The cost of granola bars at two different stores is shown below.

Food-O-Rama	Groceryland
Box of 12 granola bars $7.44	Each box has 5 granola bars 2 boxes for $6.00

What is the difference in the cost per granola bar at these two stores?

a 2¢

b 6¢

c 58¢

d 62¢

5 The temperatures at 2 a.m. and 4 a.m. on a winter day are recorded in the table.

Time	Temperature (°C)
2 a.m.	−8
3 a.m.	?
4 a.m.	−2
5 a.m.	?

If the relationship between temperature and time is linear, what are the temperatures at 3 a.m. and 5 a.m.?

a −4 °C and 0 °C

b −4 °C and 2 °C

c −5 °C and 1 °C

d −5 °C and 5 °C

8 Information about four different linear relationships is given below.

Equation:

$K = 2n + 7$

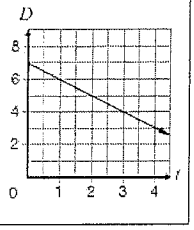
Description:

The total cost to print T-shirts is made up of a set-up fee of $65 and a cost of $7 per T-shirt.

Table:

h	T
0	10
1	17
2	24

Graph:



Which two of these linear relationships have a rate of change of 7?

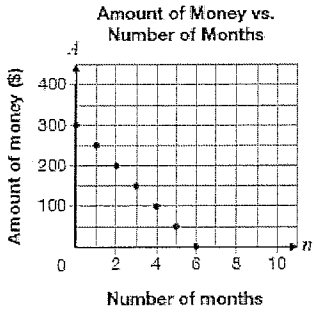
a "Table" and "Graph"

b "Table" and "Description"

c "Equation" and "Graph"

d "Equation" and "Description"

7 Information about the amount of money Aamari has left at the end of each month is shown by the graph.



Aamari started with $300 and spent the same amount each month. He reached $0 after 6 months.

If Aamari had spent $100 more per month, and had started with $300, when would he have reached $0?

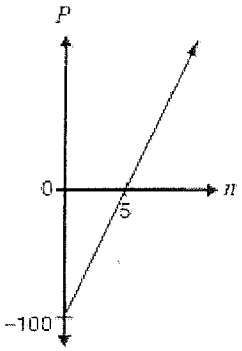
a 2 months

b 3 months

c 6 months

d 8 months

9 Joel has a summer job cutting lawns. The relationship between his profit, P, in dollars, and the number of lawns cut, n, is shown by the graph below.



What type of variation is the relationship, and what is its initial value?

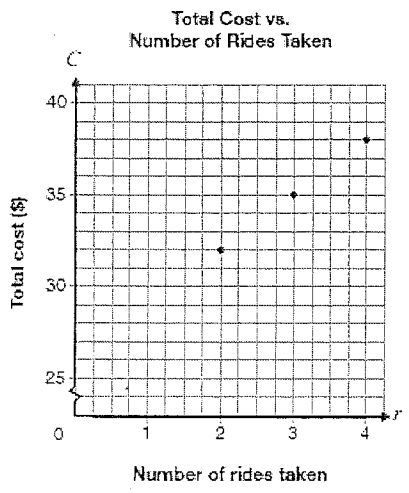
a a direct variation with an initial value of $5

b a direct variation with an initial value of −$100

c a partial variation with an initial value of $5

d a partial variation with an initial value of −$100

19 The graph below represents information about the linear relationship between the total cost of a day at the fair and the number of rides taken.



Which of the following equations represents the relationship between C and r?

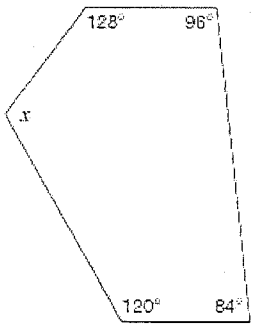
a $C = 3r$

b $C = 9.5r$

c $C = 0.75r + 26$

d $C = 3r + 26$

21 What is the value of x in the diagram below?



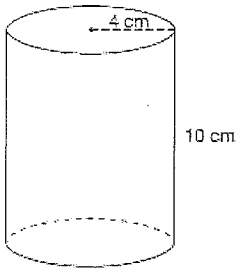
a 60°

b 68°

c 112°

d 128°

20 Orange Dream sells drinks in two sizes of cylindrical cans. The smaller can is pictured below.



The larger can has the same height and a radius that is triple the radius of the smaller can.

How many times larger is the volume of the larger can than that of the smaller can?

a 3 times larger

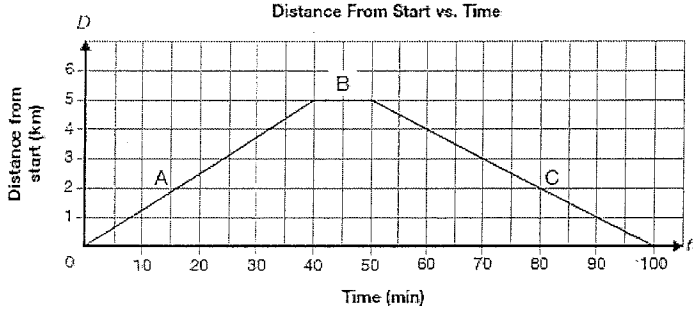
b 9 times larger

c 12 times larger

d 27 times larger

15 Charity Walk

Emily participates in a 10 km charity walk, where the walkers follow a straight path from the start then return along the same path to the finish. This graph shows the relationship between Emily's distance from the start and her time.



Describe each segment of her walk. Include information about distance travelled, time, speed in km/min and direction.

Segment	Distance travelled	Time	Speed (km/min)	Direction
A				
B				
C				

Below expectations – Grade 9 Academic

A review of questions that tripped us up last year so we don't make the same mistakes again.

1. A school is planning a car wash to raise $600.

- There will be 8 teams.
- Each team will wash 2 cars per hour.
- The car wash will last ~~5 hours~~ $5\frac{1}{2}$ hours.
- Each team will take two 15 minute breaks.

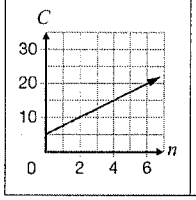
How much should the school charge per car to raise exactly $600?

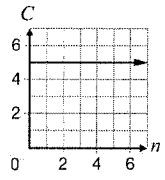
a. $15.00
b. $7.50
c. $6.82
d. $6.25

2. Information about four different linear relationships between C and n is shown below.

n	C
0	50
8	90
16	130

n	C
10	30
12	35
14	40





How many of the linear relationships have a rate of change of 5?

a. 4
b. 3
c. 2
d. 1

3. Terrific Ts

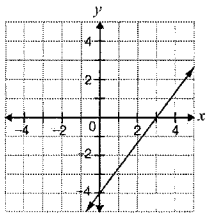
A school orders T-shirts from Terrific Ts. The total cost is made up of a set-up fee of $115 and a cost of $3 per T-shirt. Terrific Ts requires a minimum order of 25 T-shirts. The school can spend a maximum of $800. Determine all the possible values of the total cost, C, and the number of T-shirts, n, for this situation. Show your work.

The possible values of n in this situation are _____.

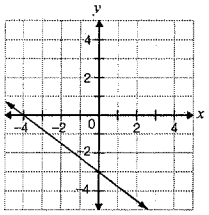
The possible values of C in this situation are _____

4. Which graph shows a line that is perpendicular to the line $y = \frac{4}{3}x - 4$?

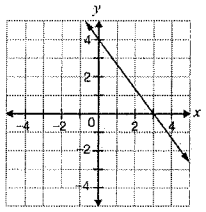
a.



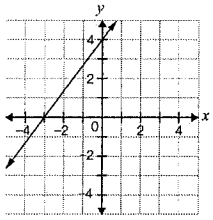
b.



c.

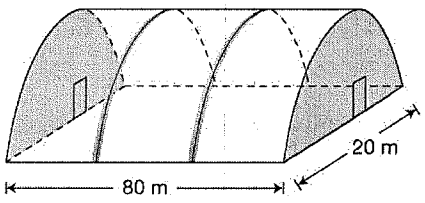


d.



5. This diagram shows a greenhouse that is built in the shape of a half-cylinder.
Material to cover the roof costs $\$3/m^2$. The shaded ends will not be covered. Which is closest to the cost of covering the roof?

a. $7540
b. $12 570
c. $15 080
d. $37 700



Solutions

Solutions

Session #1 – Solutions

1. Drippy Drops

This part does not need to be written out. It is what you should be considering when reading and interpreting the question in order to make connections

What is the question asking you to do?

- This question is asking you to decide if the points given on the graph make sense and are reasonable for the situation they described.

What does it mean if water is "leaking" from a bottle?

- Leaking means that your bottle is losing water, the volume of water in the bottle is decreasing.

What are they trying to tell us when they say "leaking at a constant rate?"

- By using the words "constant rate" they are telling us that the relationship between time and volume of water is linear. Therefore the graph of water leaking from a bottle will be a straight line.

Would you expect the line showing the relationship between volume of water remaining and time to be going up and to the right or down and to the right?

- If a line has a positive relationship that means it is going up and to the right, so, the relationship can be described like this: "As the amount of time increases the volume of water increases." Which we know is not the case in this situation.
- If a line has a negative relationship that means it is going down and to the right, so, the relationship can be described like this: "As the amount of time increases the volume of water decreases." This does model our situation!

Examine the given graph

- The title is "Volume of Water Remaining vs. Time" This title gives us hints and reminds us that the volume should be decreasing as time increases (because of the word remaining) which allows us to have an image of what our line should look like and compare it to the graph they have given us.
- The x-axis represents time in minutes and each line is going by 0.5 minutes.
- The y-axis represents volume of water remaining in (mL) and each line is 50 mL.

Consider (write out) the coordinates for point A, B, and C from the given graph.

- Point A (0, 500) Point B (2, 200) Point C (4, -100)

Have you answered the question?

- Did you circle Yes or No for each of the points and explain your choice? Did you use your math knowledge as well as logic to write your interpretations?

Point	Is this point possible?	Interpretation
A	**Circle one:** (Yes) No	The point A (0, 500) is possible because it is the initial value. This means before the bottle starts leaking it has a volume of 500mL.
B	**Circle one:** (Yes) No	The point B (2, 200) is possible because it means that in 2 minutes the bottle has lost 300 mL of water.
C	**Circle one:** Yes (No)	The point C (4, -100) seems like it should be possible because it follows the linear pattern (You've lost another 300 mL in 2 more minutes) But the -100 means the volume of water is -100 which is not possible. The bottle can't lose more water then it started with.

2. Detour

What is the question asking you to find?

- This question is asking you to find the difference in distance between taking the detour through Town A and the distance of taking the detour through Town B to get from City X to City Y.

What is a detour?

- A detour is planned route to get around a blocked off area.

What shapes do you see in the diagram provided?

- Two right angle triangles.

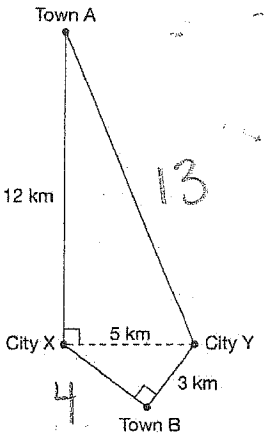
What do you know about the shapes in the diagram? How does that help you answer this question?

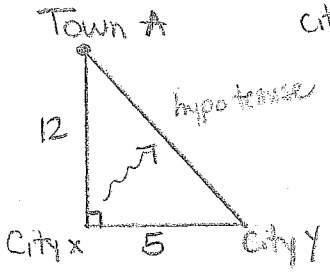
- We know how to find the perimeter of a triangle – but we are missing the value of one side of each given triangle.
- We know how to use Pythagorean Theorem to find the missing side of a right angle triangle.
- This means we need to break this question into several parts by solving both triangles separately.

Have you answered the question?

- Did you find how much shorter the detour is through Town B than the detour through Town A? Make sure you included your units and a concluding statement.

The 5 km of highway between City X and City Y is closed. There are two possible detour routes: one through Town A and one through Town B, as shown in the diagram below.





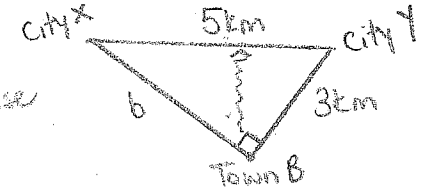
$c^2 = a^2 + b^2$

$c^2 = 12^2 + 5^2$

$c^2 = 169$

$c = \sqrt{169}$

$c = 13\text{km}$



$b^2 = c^2 - a^2$

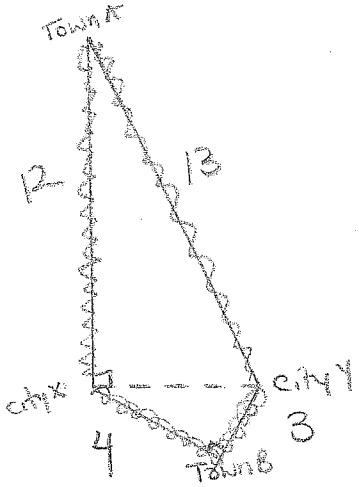
$b^2 = 5^2 - 3^2$

$b^2 = 16$

$b = \sqrt{16}$

$b = 4\text{ km}$

How much shorter is the detour through Town B than the detour through Town A?



The distance ... from City x through Town A to City Y

$= 12 + 13$

$= 25\text{ km}$

The distance ... from City x through Town B to City Y

$= 4 + 3$

$= 7\text{km}$

How much shorter... $25 - 7 = 18\text{ km}$

so the detour through Town B is 18 km shorter than through Town A

3. Three partners, Luc, Deborah and Melanie, share the profits of a business in the ratio of 2:3:7 respectively. The profit for this year is $176 496.
Determine the share of the profit for each partner.
Show your work.

Method #1

- find the unit rate

$= \frac{\text{Total profit}}{\text{total \# of parts}}$

$= \frac{176\,496}{12}$

$= \$14\,708$ per part

∴ Luc gets $2 \times 14708 = \$29\,416$

Deborah gets $3 \times 14708 = \$44\,124$

Melanie gets $7 \times 102956 = \$102\,956$

OR

Method #2

Set up & use proportional reasoning.

Luc : Deborah : Melanie : Total

L : D : m : T

$2:3:7:12 = L:D:m:176\,496$

Solve for L

$2:12 = L:176\,496$

$\frac{2}{12} = \frac{L}{176\,496}$ (Cross multiply and divide)

$L = \$29\,416$

Solve for D

$3:12 = D:176\,496$

$\frac{3}{12} = \frac{D}{176\,496}$

$D = \$44\,124$

Solve for m

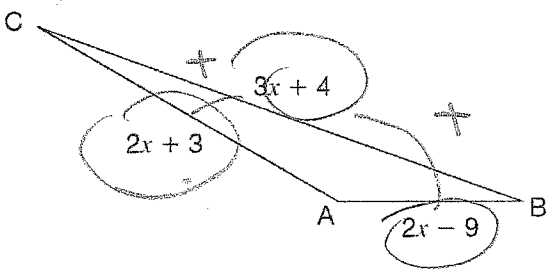
$7:12 = m:176\,496$

$\frac{7}{12} = \frac{m}{176\,496}$

$m = \$102\,956$

4. **What Side?**

The perimeter of the triangle below is 75 m.



Determine the measure of each side of the triangle.

Show your work.

$P = a + b + c$

$P = 2x - 9 + 3x + 4 + 2x + 3$ (collect & combine like terms.)

$P = 7x - 2$

If the perimeter is 75 m then,

$75 = 7x - 2$ (isolate for x)

$75 + 2 = 7x$

$77 = 7x$

$\frac{77}{7} = x$ ∴ $x = 11$

side a ⇝ $3x + 4$
$= 3(11) + 4$
$= 37\text{m}$

side b ⇝ $2x + 3$
$= 2(11) + 3$
$= 25\text{m}$

side c ⇝ $2x - 9$
$= 2(11) - 9 = 13\text{m}$

Session #2 – Solutions

1.

Think about what your initial value is. If you order zero toppings how much will the pizza cost?

- It cost $3 just for the pizza. This means we should have the point (0, 3) in are table or on our graph.

What is the rate of change?

- It costs $3 per 1 topping. This means we should have a slope of $\frac{3}{1}$.
- Be careful though, your tables might not always be going up by 1 each time.

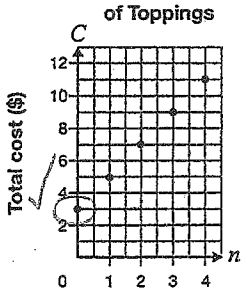
A restaurant charges $3 for a cheese pizza plus $2 per additional topping.

Which of the following shows two models that represent the relationship between the total cost of a pizza, C, and the number of additional toppings on it, n?

a

Number of toppings, n	Total cost, C ($)
0	3
2	7
4	11
6	15

Total Cost vs. Number of Toppings

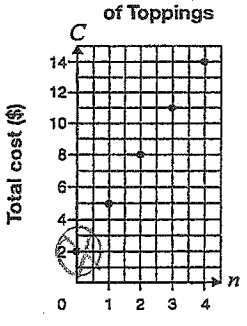


Number of toppings

b

$C = 3n + 2$

Total Cost vs. Number of Toppings

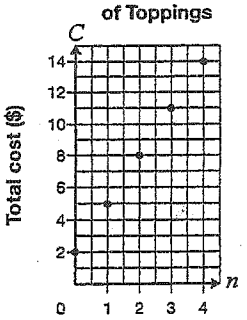


Number of toppings

c

Number of toppings, n	Total cost, C ($)
0	2
2	8
4	14
6	20

Total Cost vs. Number of Toppings



Number of toppings

d

$C = 2n + 3$

Number of toppings, n	Total cost, C ($)
0	3
1	5
2	8
3	11

2. Consider the following equation:

$$c^2 = 6^2 + 10^2$$

Which is closest to the value of c?

~~a) 4~~ } has to be bigger
~~b) 6~~ } than 10
c) 12
d) 16

• We know that "c" the hypotenuse, must be the longest side.
• rule out (eliminate any # smaller than 10)

Solve:

$c^2 = 36 + 100$

$c^2 = 136$

$c = \sqrt{136}$ $c = 11.66$

3. What value of x makes the equation $4x - 5 = -6x + 15$ true?

a) 2
b) 1
c) -5
d) -10

Solve

$4x - 5 = -6x + 15$

$4x + 6x = 15 + 5$

$10x = 20$

$x = \frac{20}{10}$

$x = 2$

OR Trial and Error

check (a) sub $x = 2$ into the equation

$4(2) - 5 = -6(2) + 15$

$8 - 5 = -12 + 15$

$3 = 3$

we got lucky and the first value we tested works ☺

e) Ella wants a rectangle with
- A perimeter of 100 cm and
- The largest possible area. → this means make a square

What are the dimensions of the rectangle that satisfies her conditions?

~~a) 10 cm × 10 cm~~ 10+10+10+10=40 (needs to be 100)
~~b) 20 cm × 30 cm~~ not a square
c) 25 cm × 25 cm 25+25+25+25=100 ✓
~~d) 40 cm × 40 cm~~ 40+40+40+40 = 160

• eliminate any dimensions that don't make a square.
• check that they have a perimeter of 100 m

Session #3 – Solutions

∴ it will go up/down by the same amount each time

1. There is a linear relationship between the total cost of renting a costume and the number of hours the costume is rented.
   - For 3 hours, the total cost is $60.
   - For 5 hours, the total cost is $80.

What type of variation is this relationship, and what is its initial value?

- they are asking for the y-int. If it's "0" then this is direct

a. A partial variation with an initial value of $30.
b. A partial variation with an initial value of $20.
c. A direct variation with an initial value of $30.
d. A direct variation with an initial value of $20.

Hours (x)	Cost (y)
3	60
5	80

(2 between hours; 20 between costs)

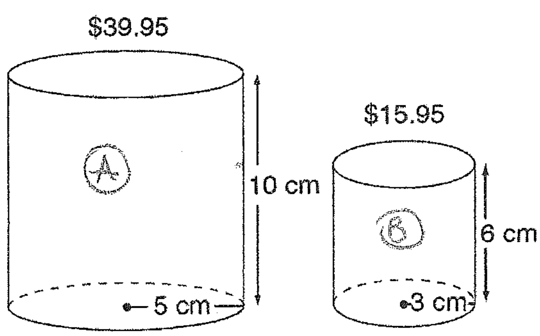
Rate of change is $\frac{20}{2} = \frac{10}{1}$

∴ cost is $10 per 1 hour

0	30
1	40
2	50
3	60

(each step > 10)

2. Two different stores sell coffee in cylindrical packages. The prices and dimensions of the packages from the two stores are shown below.



Which is closest to the difference between the unit prices of these two packages?

a $0.04/cm³
b $0.05/cm³
c $0.09/cm³
d $0.24/cm³

1. Find the volume of each

(A)
$V = \pi r^2 h$
$V = (3.14)5^2(10)$
$V = (3.14)(25)(10)$
$V = 785 \text{ cm}^3$

(B)
$V = (3.14)(3)^2(6)$
$V = (3.14)(9)(6)$
$V = 169.56$

2. Find the unit cost for each (How much it costs for 1 cm³)

$\$: V = \frac{\$}{V}$

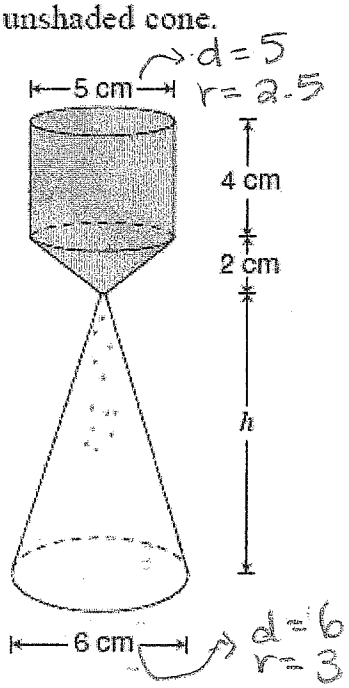
(A) $= \frac{39.95}{785} = \$0.05/\text{cm}^3$

(B) $= \frac{15.95}{169.56} = \$0.09/\text{cm}^3$

3. Find the difference in cost

$= 0.09 - 0.05$
$= \$0.04/\text{cm}^3$

3. Sand is being poured from one container to another, as shown below. The sand flows from the shaded part to the unshaded cone.



The shaded part starts full of sand. The sand empties into the unshaded cone and fills it to the top. What is the height of the unshaded cone?

F 6.0 cm

G 8.3 cm

(H) 9.7 cm

J 12.5 cm

The Volume of shaded figure equals Volume of unshaded

Composite figure

1. find volume of shaded cylinder

$V = \pi r^2 h$

$V = (3.14)(2.5)^2(4)$

$V = 78.5\ cm^3$

2. find Volume of shaded cone

$V = \frac{\pi r^2 h}{3}$

$V = \frac{(3.14)(2.5)^2(2)}{3}$

$V = 13.08\ cm^3$

3. find total volume of shaded figure

$= 78.5 + 13.08$

$= 91.58\ cm^3$

4. find the height of unshaded cone

$V = \frac{\pi r^2 h}{3}$

$V = \frac{(3.14)(3)^2 h}{3}$

$91.58 = \frac{(3.14)(3)^2 h}{3}$

$91.58 \times 3 = (3.14)(9)h$

$274.74 = 28.26h$

$\frac{274.74}{28.26} = h$

$h = 9.7\ cm$

- we still have 2 variables... what are we forgetting? Volume of shaded = Volume of unshaded

Session #4– Solutions

1.

What is the question asking you to find?

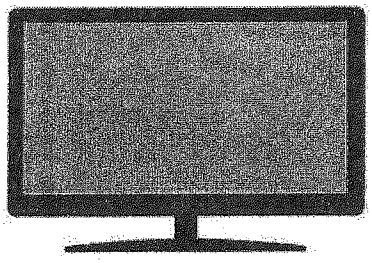
- The difference in the sale price of the tv sold at Fair Deal and Big Big Discount.

Express the problem in a logical way.

- $Discount = \frac{percent}{100} \times regular\ price$
- Sale price = regular price – discount

Try and write "percent of a number"
20% of 599.99
0.20 x 599.99 (of means x)

Sam is interested in buying a TV. At Fair Deal, the TV is regularly priced at $599.99 and is on sale for 20% off the regular price. At Big Big Discount, the same TV is regularly priced at $899.99 and is on sale for 30% off the regular price.



subtraction

What is the difference in the sale price of the TV between these two stores?

Fair Deal

Discount = $\frac{20}{100} \times 599.99$

$= 0.2 \times 599.99$

Discount = $119.99

Sale Price = reg price - discount

$= 599.99 - 119.99$

$= \$480$

∴ the sale price at Fair Deal is $480

Big Big Discount

Discount = 30% of 899.99

$= 0.3 \times 899.99$

$= \$269.99$

Sale price = 899.99 − 269.99

$= \$630$

∴ sale price at B.B.D is $630.

Big Big Discount - Fair Deal

$= 630 - 480$

$= \$150$

∴ Fair Deal is $150 cheaper

2. There are two payment options for downloading movies from a Web site.

- Option A: Pay $30 for a membership and $2 per movie downloaded.
- Option B: Shown on the grid below.

initial value = y-int

↳ rate of change = $\frac{2}{1}$ = rise 2 run 1

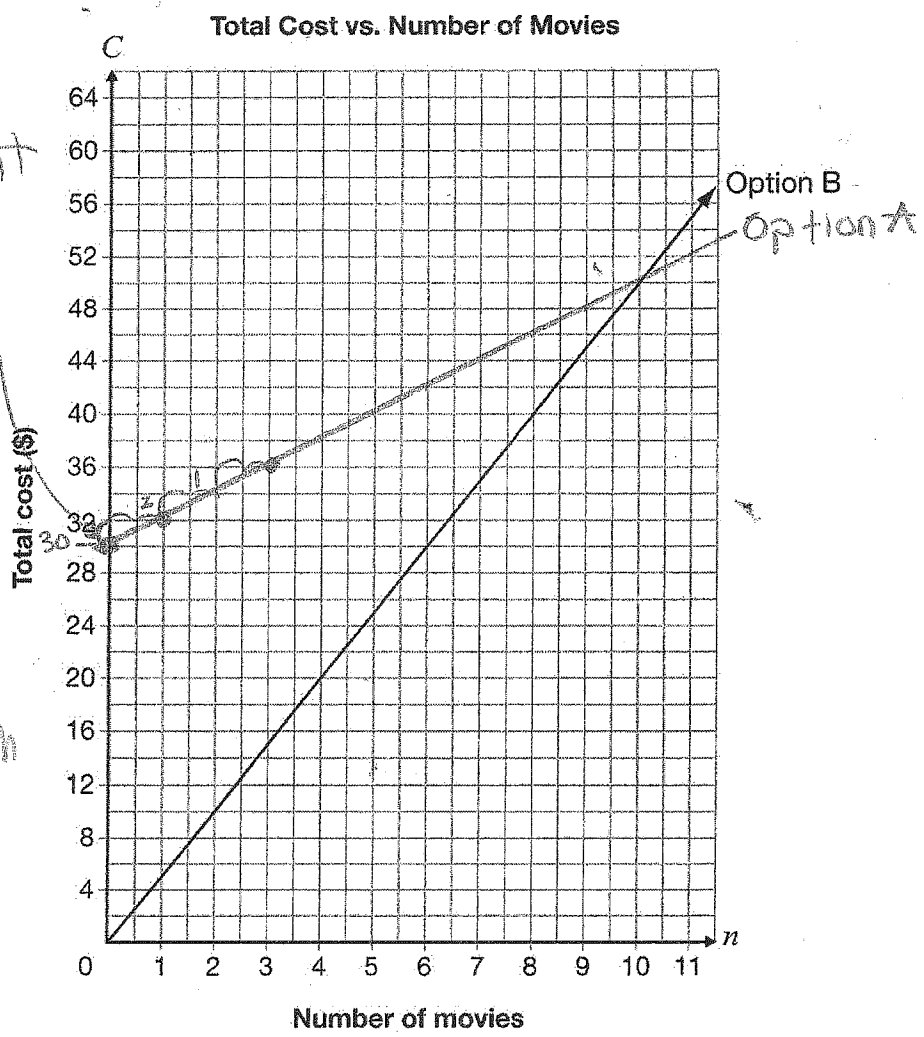
Graph Option A by:

> point a point to represent your initial value

> use your rate of change to rise 2 from your y-int and run 1. Put your next point there

* watch the scale on the "x" or "n-axis" and y or "C axis"

=> connect your points with 1 long straight line



Determine under which conditions a person should select Option A and under which conditions a person should select Option B.

Justify your answer.

The point of intersection (where the two lines touch) is (10, 50)

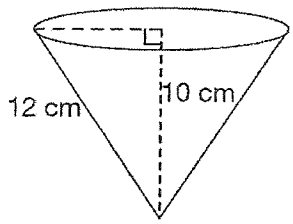
This means 10 movies cost $50 for both option A & option B.

∴ If you are renting less then 10 movies you should choose Option B

If you are renting more then 10 movies you should choose Option A.

3. **Cone Zone**

Zach measures the slant height of a cone-shaped cup and finds that it is 12 cm. The height is 10 cm.



Determine the volume of water in the cup if Zach fills it to the top.

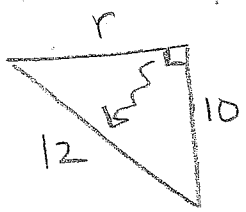
Show your work.

$$V = \frac{\pi r^2 h}{3}$$

$V = ?$
$\pi = 3.14$
$r = ?$
$h = 10$

} we are missing both the Volume and radius.
∴ we need to find the radius before we can solve for volume

What shape do you see? Right angle triangle ∴ use Pythag. thm



* slant height means hypotenuse

$r^2 = 12^2 - 10^2$
$r^2 = 144 - 100$
$r^2 = 44$
$r = \sqrt{44}$
$r = 6.6$ cm

Now solve for the Volume.

$$V = \frac{(3.14)(6.6)^2(10)}{3}$$

$$V = \frac{(3.14)(43.56)(10)}{3}$$

$V = 455.93 cm^3$

∴ The Volume of water in the full cup is about $455.93 cm^3$

Session #5– Solutions

1.

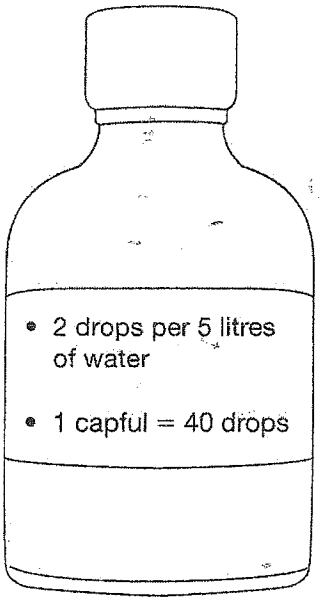
This question is testing your understanding of ratios and proportional reasoning.

- When I answer this question using the concepts taught in class my solution looks like the one shown below.
- However, you might answer this question using logical reasoning and your solution might look more similar to the sample EQAO solution on the next page.
- Either solution would earn you a perfect score of 40, as long as the solution is justified.

James adds vitamin drops to his fish tank to keep his fish healthy.

If James follows the instructions on the bottle of vitamins, how many capfuls should he add to his 350-litre fish tank?

Show your work.



① ratio for: number of drops : number of litres
· let x rep. the number of drops for 350L.

$2:5 = x:350$

$\frac{2}{5} = \frac{x}{350}$

$\frac{700}{5} = x$

$x = 140$

∴ 140 drops for 350L

② ratio for number of capfuls : number of drops
· let x rep the number of capfuls for 140 drops.

$1:40 = x:140$

$\frac{1}{40} = \frac{x}{140}$

$\frac{140}{40} = x$

$x = 3.5$

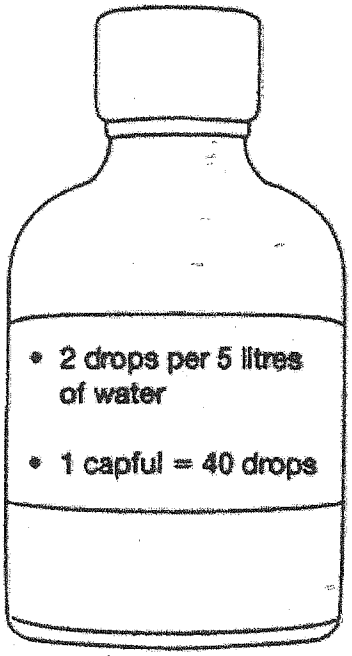
∴ He should add 3.5 capfuls to his 350-litre fish tank

Healthy Fish

James adds vitamin drops to his fish tank to keep his fish healthy.

If James follows the instructions on the bottle of vitamins, how many capfuls should he add to his 350-litre fish tank?

Show your work.



5L = 2 drops
1 cap = 40 drops

5L x 70L = 350L
2 drops x 70 = 140 drops

1 cap = 40 drops
2 caps = 80 drops
3 caps = 120 drops
4 caps = 160 drops

☺ James should add 3 1/2 caps of the vitamin drops to keep his fish happy. I know this because per 350L there should be 140 drops, and per 1 capful = 40 drops so 3 1/2 cap fulls would satisfy his 350L fish tank.

2.

This question is testing your understanding of slope.

- When I answer this question using the concepts taught in class(whichever situation has the bigger slope means it grows at a greater rate) my solution looks like the one shown below.
- However, you might answer this question by graphing Lucia's information on the grid below and compared which line is steeper (like the sample EQAO solution provided on the next page)
- Either solution would earn you a perfect score of 40, as long as the solution is justified.

Lucia and Paul each have a plant. Both plants grow at a constant rate.

Lucia records information about the height of her plant in a table,

and Paul graphs his results as shown below.

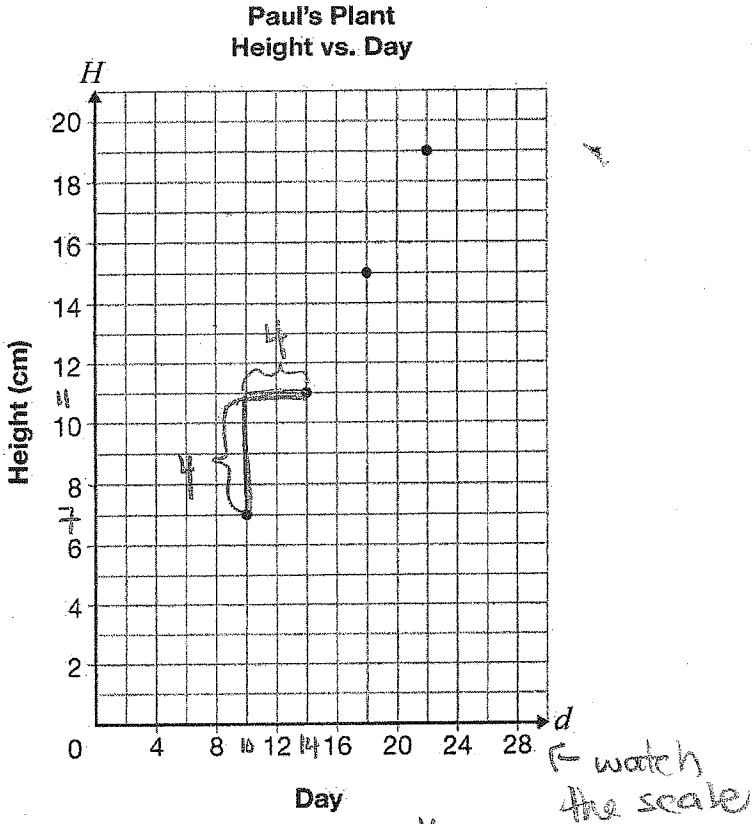
Lucia's Plant

Day (X)	Height (cm) (Y)
4	8
7	10
10	12
13	14

3, 3, 3 | 2, 2, 2

Slope = $\frac{\text{change in } Y}{\text{change in } X}$

Lucia's slope = $\frac{2}{3}$



Pauls slope = $\frac{4}{4}$

Whose plant is growing faster?

Circle one: Lucia's (Paul's)

Justify your answer.

$\frac{4}{4} > \frac{2}{3}$ ∴ Pauls grew faster.

Growing Rates

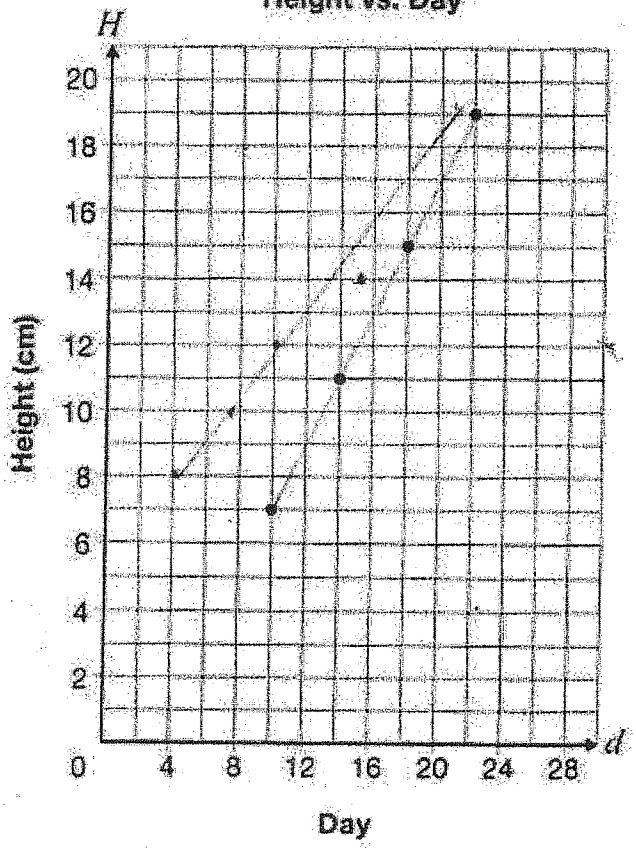
Lucia and Paul each have a plant. Both plants grow at a constant rate.

Lucia records information about the height of her plant in a table, and Paul graphs his results as shown below.

Lucia's Plant

Day	Height (cm)
4	8
7	10
10	12
13	14

Paul's Plant
Height vs. Day



Whose plant is growing faster?

Circle one: Lucia's (Paul's)

Justify your answer.

Pauls grew faster because his graph indicates that his is steeper so that telles me his grew faster

Below expectations – Grade 9 Applied

A review of questions that tripped us up last year so that we don't make the same mistakes again.

1 The cost of granola bars at two different stores is shown below.

Food-O-Rama	Groceryland
Box of 12 granola bars $7.44	Each box has 5 granola bars 2 boxes for $6.00

What is the difference in the cost per granola bar at these two stores?

(a) 2¢
b 6¢
c 58¢
d 62¢

Food O Rama
$\frac{7.44}{12} = \$0.62$/bar
Groceryland
5 per box × 2
= 10 per box
$\frac{\$6.00}{10} = \$0.60$/bar
$0.62 - 0.60 = \$0.02$
$\$0.02 = 2¢$

5 The temperatures at 2 a.m. and 4 a.m. on a winter day are recorded in the table.

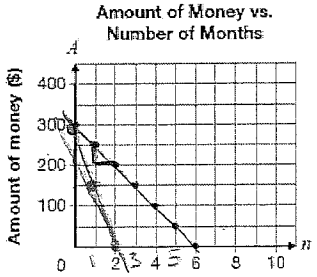
Time	Temperature (°C)
2 a.m.	−8
3 a.m.	? −5
4 a.m.	−2
5 a.m.	? 1

You can trial & Error
$-5 - -8 = -5 + 8 = 3$
$-2 - -5 = -2 + 5 = 3$
$1 - -2 = 1 + 2 = 3$
linear

If the relationship between temperature and time is linear, what are the temperatures at 3 a.m. and 5 a.m.?

a −4 °C and 0 °C
b −4 °C and 2 °C
(c) −5 °C and 1 °C
d −5 °C and 5 °C

7 Information about the amount of money Aamari has left at the end of each month is shown by the graph.



Aamari started with $300 and spent the same amount each month. He reached $0 after 6 months.

If Aamari had spent $100 more per month, and had started with $300, when would he have reached $0?

(a) 2 months
b 3 months
c 6 months
d 8 months

$m = \frac{50}{1}$ or $50/month
50 + 100
= 150/month

8 Information about four different linear relationships is given below.

Equation:
$K = 2n + 7$
m = 2

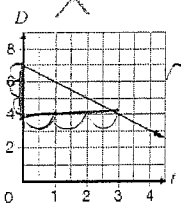
Description:
The total cost to print T-shirts is made up of a set-up fee of $65 and a cost of $7 per T-shirt.
m = 7

Table:

h	T
0	10
1	17
2	24

m = 7

Graph:

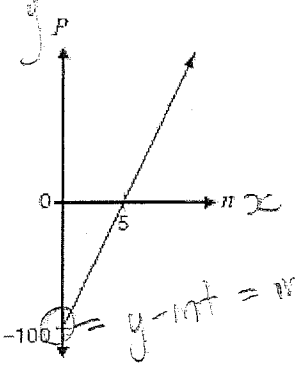


m = 3/3

Which two of these linear relationships have a rate of change of 7?

a "Table" and "Graph"
(b) "Table" and "Description"
c "Equation" and "Graph"
d "Equation" and "Description"

9 Joel has a summer job cutting lawns. The relationship between his profit, P, in dollars, and the number of lawns cut, n, is shown by the graph below.

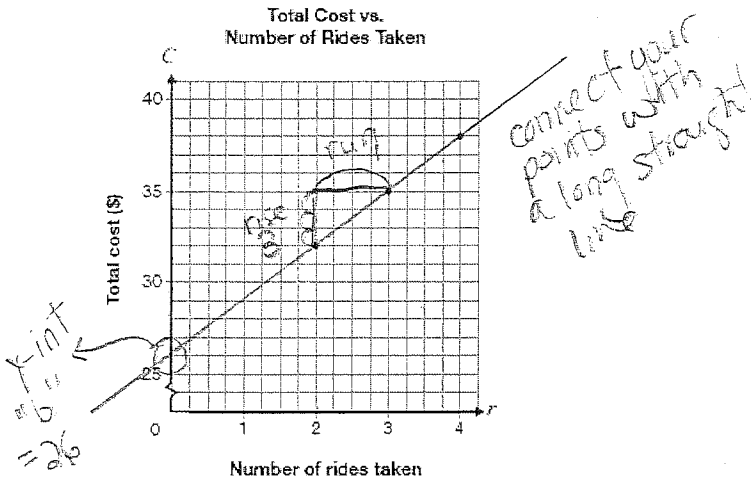


doesn't touch the axis in (0,0) so partial
y-int = initial amount

What type of variation is the relationship, and what is its initial value?

a a direct variation with an initial value of $5
b a direct variation with an initial value of −$100
c a partial variation with an initial value of $5
(d) a partial variation with an initial value of −$100

10 The graph below represents information about the linear relationship between the total cost of a day at the fair and the number of rides taken.



Which of the following equations represents the relationship between C and r?

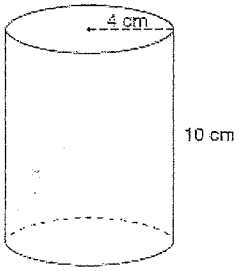
a $C = 3r$

b $C = 9.5r$

c $C = 0.75r + 26$

d $C = 3r + 26$

20 Orange Dream sells drinks in two sizes of cylindrical cans. The smaller can is pictured below.



The larger can has the same height and a radius that is triple the radius of the smaller can.

How many times larger is the volume of the larger can than that of the smaller can?

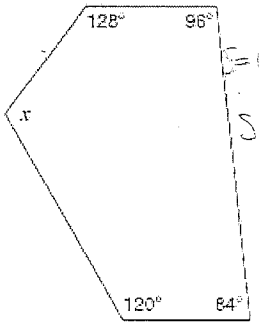
a 3 times larger

b 9 times larger

c 12 times larger

d 27 times larger

21 What is the value of x in the diagram below?



a 60°

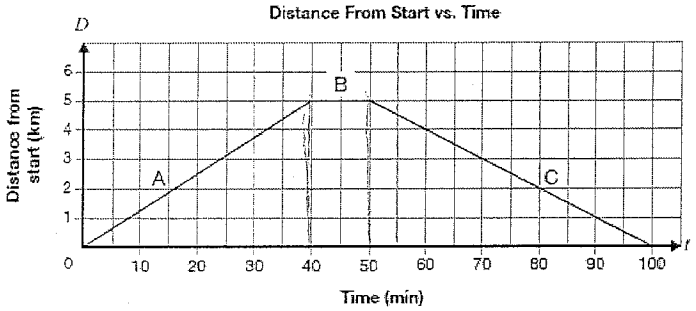
b 68°

c 112°

d 128°

15 Charity Walk

Emily participates in a 10 km charity walk, where the walkers follow a straight path from the start then return along the same path to the finish. This graph shows the relationship between Emily's distance from the start and her time.



Describe each segment of her walk. Include information about distance travelled, time, speed in km/min and direction.

Segment	Distance travelled	Time	Speed (km/min)	Direction
A	5km	40 min	$\frac{5}{40}$ = 0.125km/min	away from the starting point
B	0km	10 min	0 km/min	Resting / stopped walking
C	5km	50 min	$\frac{5}{50}$ = 0.1 km/min	Back to the starting point

Below expectations – Grade 9 Academic

A review of questions that tripped us up last year so we don't make the same mistakes again.

1. A school is planning a car wash to raise $600.
- There will be 8 teams.
- Each team will wash 2 cars per hour.
- The car wash will last ~~5 hours~~.
- Each team will take two 15 ~~minute~~ minute breaks.

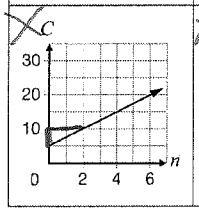
How much should the school charge per car to raise exactly $600?

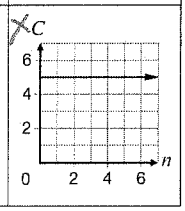
a. $15.00
b. $7.50
c. $6.82
d. $6.25

2. Information about four different linear relationships between C and n is shown below.

n	C
0	50
8	90
16	130

n	C
10	30
12	35
14	40





How many of the linear relationships have a rate of change of 5?

a. 4
b. 3
c. 2
d. 1

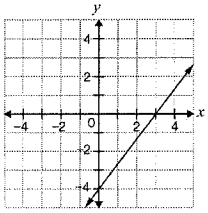
3. **Terrific Ts**
A school orders T-shirts from Terrific Ts. The total cost is made up of a set-up fee of $115 and a cost of $3 per T-shirt.
Terrific Ts requires a minimum order of 25 T-shirts.
The school can spend a maximum of $800.
Determine all the possible values of the total cost, C, and the number of T-shirts, n, for this situation.
Show your work.

The possible values of n in this situation are _____.

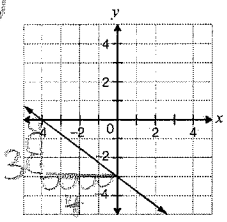
The possible values of C in this situation are _____.

4. Which graph shows a line that is perpendicular to the line $y = \frac{4}{3}x - 4$?

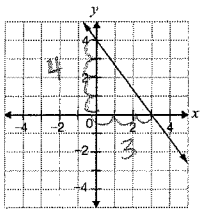
a.



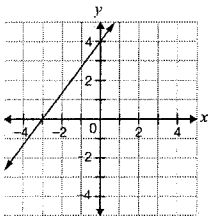
b.



c.



d.



5. This diagram shows a greenhouse that is built in the shape of a half-cylinder.
Material to cover the roof costs $3/m^2. The shaded ends will not be covered. Which is closest to the cost of covering the roof?

a. $7540
b. $12 570
c. $15 080
d. $37 700