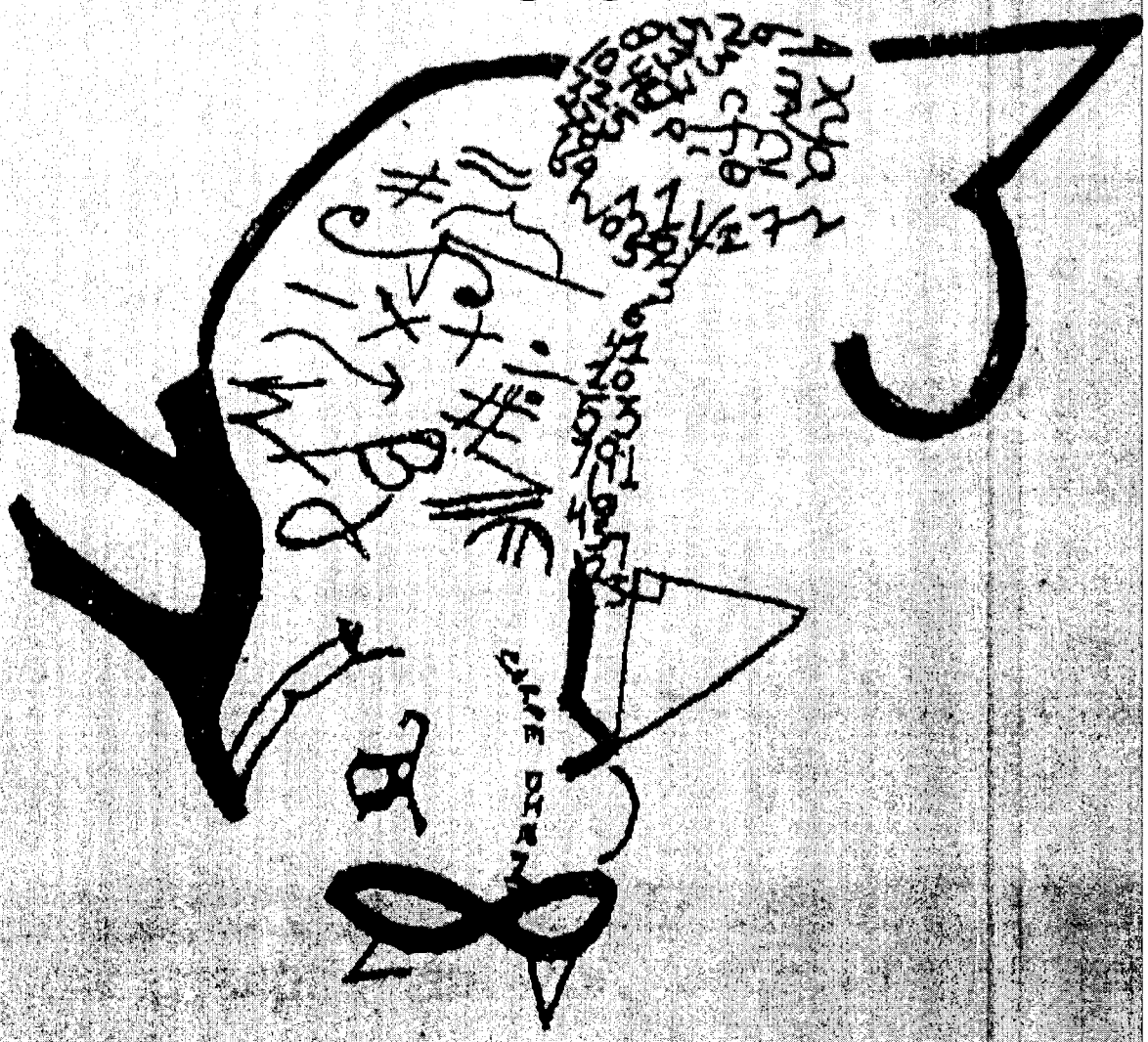
Grade 9 Applied Math



Course Review

Unit #1 - Number Sense

Order of Operations:
Brackets
Exponents
Division
Multiplication
Addition
Subtraction

Remember to watch your negative sign when dealing with exponents.

$$(3)^2 = 3 \times 3 = 9$$

$$(-3)^2 = (-3) \times (-3) = 9$$

$$-3^2 = -(3) \times (3) = -9$$

Example – Simplify $3[2^2 - 4(-5)] + 10$

Follow BEDMAS	$\mathbf{3[2^2 - 4(-5)] + 10}$
B = brackets If you have work to do inside your brackets you start there. If there are multiple steps to do inside the brackets you must simplify every inside first following BEDMAS.	Inside the brackets we have: $2^2 - 4(-5)$ B – There are still brackets, but there is no work to complete inside of them. So, we move on. E – We have an exponent so we do that next: $= 4 - 4(-5)$ D – There's no division. So, we move on. M – We have a multiplication so we do that next: $= 4 - (-20)$ $= 4 + 20$ A – We have an addition so we do that next: $= 24$ S – There's no subtraction. Remember, what we just found was the simplified work inside the brackets. So now the question looks like: $\mathbf{=3[24] + 10}$
E = exponents None so we move on	$\mathbf{= 3[24] + 10}$
D = division None so we move on	$\mathbf{= 3[24] + 10}$
M - multiplication	$\mathbf{= 72 + 10}$
A - addition	$\mathbf{= 82}$
S – subtraction None so we are done	

Unit #2 - Ratios

Example- If every class has to have 3 girls for every 2 boys, how many girls does a class of 40 boys have to have?

1. Always start by writing your ratio (what you are comparing) in words.	In this case we are comparing; number of girls to the number of boys in a class. **girls:boys** OR **G:B**
2. Write a proportional statement. By replacing your words with numbers and setting one ratio equal to what you are trying to solve for.	**3:2 = G: 40**
3. Rewrite your ratios as fractions. Put the left value over the right value in your ratio.	$\frac{3}{2} = \frac{G}{40}$
4. Cross multiply and divide.	$\frac{3}{2} = \frac{G}{40}$ $3(40) = 2G$ $120 = 2G$ $\frac{120}{2} = G$ $60 = G$
5. Write a concluding statement	**A class with 40 boys must have 60 girls.**

Unit Rates:

Divide by the number that you want to have 1 of.

Example- A case of 24 pops cost $7.20. How much does 1 pop cost?

$= \frac{7.20}{24}$

$= 0.30$

∴ It will cost $0.30 per pop.

Percents:

Always start a percent question by writing/completing this sentence:

_____ of _____
Percent *Total*

Remember "of" means to multiply in math

A percent is always out of 100

Example - A pair of jeans regularly costs $80 and are on sale for 20% off. What is the sale price of the jeans?

Start by calculating your Discount.
20% of 80
$= \frac{20}{100} \times 80$
$= 0.20 \times 80$
$= \$16$

Then, calculate your Sale Price.
Sale price = regular price – discount
= 80-16
=$64

∴ The sale price is $64

Unit #3 - Polynomials

- Like terms have the same variable (letter) and the same exponent.

Simplifying Polynomials	
• Identify like terms • Collect like terms (rearrange them so that they are side by side) • Combine like terms (add or subtract)	$2x + 10 - 3x + 2 + 9x$ $= 2x - 3x + 9x + 10 + 2$ $= 8x + 12$

Adding Polynomials	
• Remove the brackets. • Collect like terms. • Combine (add or subtract) like terms.	$(3x - 10) + (2x - 4)$ $3x + 10 + 2x - 4$ $3x + 2x - 10 - 4$ $= 5x - 14$

Subtracting Polynomials	
• Remove the brackets from the first polynomial • Remove the brackets on the second polynomial by multiplying each term in the second bracket by -1. (Or just change the sign of every term in the second polynomial.) • Collect like terms. • Combine like terms.	$(2x + 3) - (5x - 10)$ $2x + 3 - (5x - 10)$ $2x + 3 - 5x + 10$ $2x - 5x + 3 + 10$ $= -3x + 13$

Expanding (Multiplying) Polynomials	
• Multiply the term stuck to the left of your bracket with everything inside your bracket. • Remember numbers times numbers and letters times letters.	$2(3x - 5)$ $= 6x - 10$ $x(4x + 3)$ $= 4x^2 + 3x$ $-3x(-2x + 1)$ $= 6x^2 - 3x$

Chapter #4 – Solving Equations

Key Points:

- Use inverse (opposite) operations
- Reverse BEDMAS

Inverse Operations:
$+ \leftrightarrow -$
$\times \leftrightarrow \div$
$\square^2 \leftrightarrow \sqrt{}$

Solving One-Step Equations:

Original Question	***Read as:***	***Do the opposite***	***Solution***
$2x = 28$	2 times x equals 28	Divide by 2	$x = \frac{28}{2}$ $x = 14$
$x - 3 = 11$	x minus 3 equals 11	Add 3	$x = 11 + 3$ $x = 14$
$\frac{x}{3} = 4$	x divided by 3 equals 4	Times by 3	$x = 4(3)$ $x = 12$

Solving Multi-Step Equations:

Original Question	***Read as:***	***Do the opposite***	***Solution***
$120 = 10r^2 3$	**You can clean this question up first to make it easier to solve:* $120 = 30r^2$ 120 equals 30 times r squared	*Reverse BEDMAS by doing addition/subtraction first, followed by multiplication/division, then exponents and lastly anything in your bracket.* So, Divide by 30 and take the square root of your answer.	$\frac{120}{30} = r^2$ $4 = r^2$ $\sqrt{4} = r$ $2 = r$

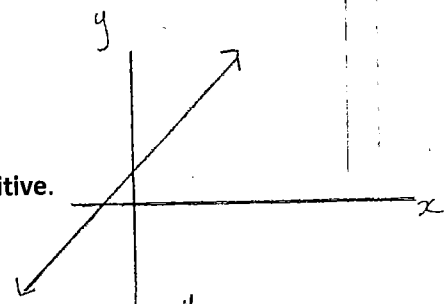
If you are answering a **multiple choice** question for solving equations you can always use **trial and error** by testing each of the possible answers they give you in the question.

Chapter #5&6 –Linear Relations

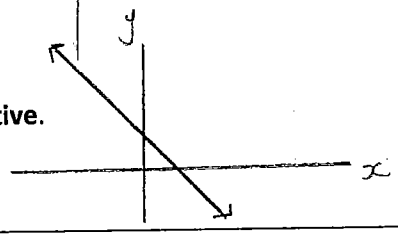
Coordinates are always (x, y)

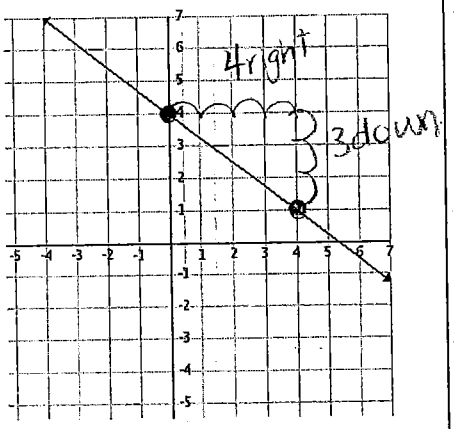
Key Points:

- If your line is going **up and to the right** your slope will be **positive**.
  (As your x values get bigger your y values also get bigger)



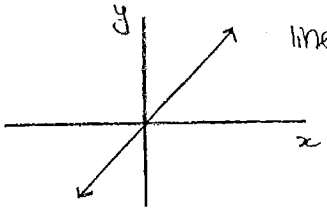
- If your line is going **down and to the right** your slope will be **negative**.
  (As your x values get bigger your y values get smaller)

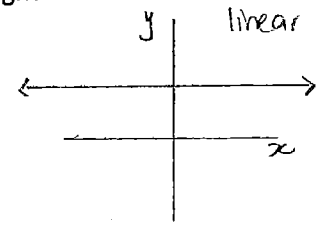


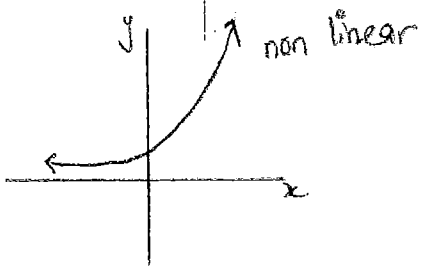
Slope is the same as: Steepness of a line, m, rate of change, speed, rise over run		
Calculating Slope: **From a Graph**	• Pick two easy to read points on your line. • Count how much you rise (up or down) and run (left or right) to get from one point to the other point you chose on your line. • Write your answer as: $m = \frac{rise}{run}$	 $m = \frac{-3}{4}$
Calculating Slope: **From a table of values**	• Make sure your points are in order (smallest x value first) • Calculate your first differences. • Write your answer as $m = \frac{rise}{run}$	change in x / change in y x: 0, 2, 4, 6 y: 0, 1, 2, 3 +2, +2, +2 +1, +1, +1 Change in y = 1 Change in x = 2 $Slope\ (m) = \frac{\textbf{change in } y}{\textbf{change in } x} = \frac{1}{2}$

How to tell if a relation is linear or non-linear:

- **"Constant Rate"** means it's a straight line!
- **<u>From a graph</u>** - if you have a straight line = linear







- **<u>From a table of values</u>** – if he first differences are constant (all equal) = linear

x	y
0	2
1	4
2	6
3	8

$4-2=2$, $6-4=2$, $8-6=2$ all the same number ∴ linear

x	y
0	2
1	3
2	5
3	8

$3-2=1$, $5-3=2$, $8-5=3$ not all the same number ∴ non linear

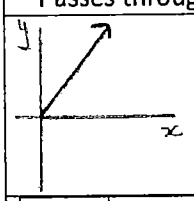
- **<u>From an equation</u>** – if the degree of the equation is 1 = linear

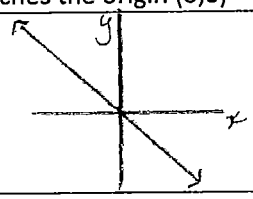
$y = 3x^1 + 2$ exponent is a "1" ∴ linear

$y = 3x^2 + 2$ exponent is a "2" ∴ not linear

Equation of a line: $y = mx + b$
m is the slope of your line
b is the y-intercept

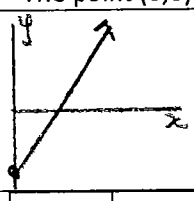
Direct Variation	Partial Variation
Straight line	Straight line
Passes through/touches the origin (0,0)	The point (0,0) does not exists on the line

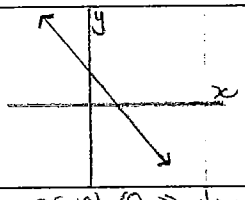




x	y
-1	-4
0	0
1	4

The point (0,0) exists ∴ initial value is 0
$b = 0$





x	y
-1	-4
0	-2
1	0

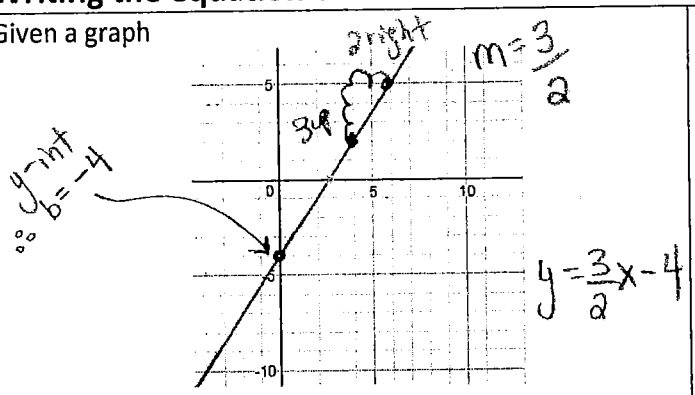
The point (0,0) does not exist.
Initial value is -2
$b = -2$

$y = mx$	$y = mx + b$
Ex: $y = 3x$ or $y = -\frac{5}{3}x$	Ex: $y = 3x - 10$ or $y = -\frac{5}{3}x + 2$

Graphing a Line	
Given the equation of your line in slope/y-intercept form. ($y = mx + b$)	• Put a point at your y-intercept. (0,b) • From that point rise and run the value of "m" and put a new point there. • Connect your points using a ruler and extend your line

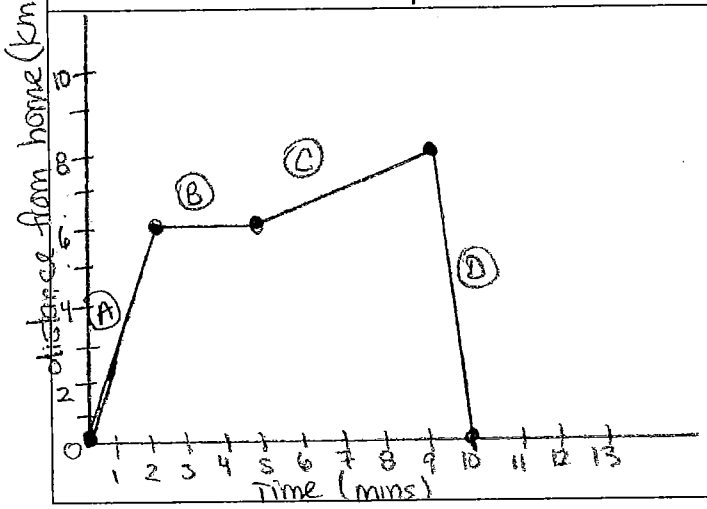
Writing the equation of a line

Given a graph



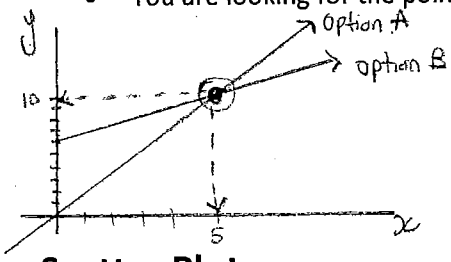
- You need to write $y = mx + b$, but, replace the "m" and the "b" with the number you get from the graph.
- Remember $m = slope = \frac{rise}{run}$
- $b = y - intercept$
  - Where the line crosses/touches the y-axis
  - The "initial amount"
  - Flat fee or fixed amount

Distance-Time graphs

Graph	Explanation
	Section A: Moving **away** from starting position Distance = 62km Time = 2 min. Speed = $\frac{6}{2} = 3km/min$
	Section B: Distance not changing Distance = 0 Time = 3min. Speed = $\frac{0}{3} = 0km/min$
	Section C: Moving **away** from starting position Distance = 2km Time = 4 min. Speed = $\frac{2}{4} = 0.5km/min$
	Section D: Moving **towards** starting position Distance = 8km Time = 1 min. Speed = $\frac{8}{1} = 8km/min$

Two Linear Relations

- You are looking for the point of intersection (where both lines have the same x and y)

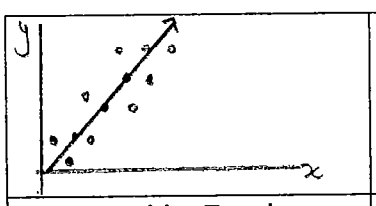
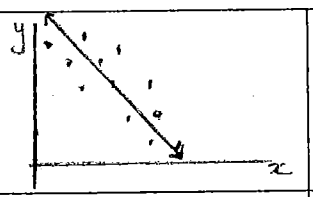
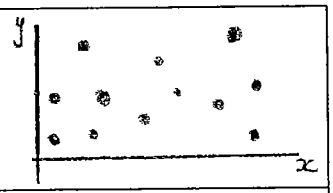


Your answer should be:

If less then _____ I would choose _____.
x value of the point of intersection

If more then _____ I would choose _____.
x value of the point of intersection

Scatter Plots:

		
Positive Trend	**Negative Trend**	**No Trend**

Line of best fit:

- Must follow the trend
- Should be at the center of your data points

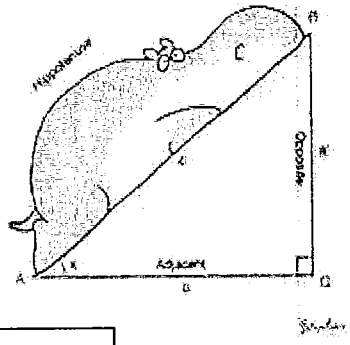
Chapter #7 – Measurement

Pythagorean Theorem

You can only use Pythagorean Theorem to solve for a missing side of a right angle triangle.

The hypotenuse is:

- ✓ The longest side in your triangle
- ✓ The diagonal line
- ✓ The side of the triangle that is opposite the 90° angle
- ✓ The slant height

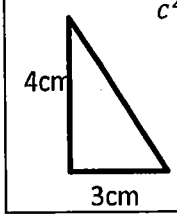


The legs are:

- ✓ The two shorter sides in your right angle triangle
- ✓ The two sides that meet at (touch) the 90° angle

To solve for the hypotenuse (c) use:

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



$$c^2 = 4^2 + 3^2$$
$$c^2 = 16 + 9$$
$$c^2 = 25$$
$$c = \sqrt{25}$$
$$c = 5cm$$

To solve for one of the legs rearrange the Pythagorean Theorem to isolate for the missing leg and use:

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

Perimeter:	**Area:**	**Volume**
• Distance around the outside of your shape. • Example – the amount of fencing needed to go around your backyard. • Common units: cm, m , km	• Square units inside a 2D figure. • Example – the amount of paint needed to cover a wall. • Common units: cm^2, m^2, km^2	• Capacity of a 3D shape. • Example – the amount of water to fill a fish tank. • Common units: cm^3, m^3, km^3

USE YOUR FORMULA SHEET

Composite Figures

a) Identify what familiar shapes make up the figure you have (use as few shapes as possible).
b) Determine any missing lengths that you may need. Remember that sometimes you will have to use Pythagorean Theorem to find a missing side.
c) Find the area or volume of each shape and either add or subtract them, depending on the figure.
d) For perimeter add all of the lengths on the outside of your figure only.

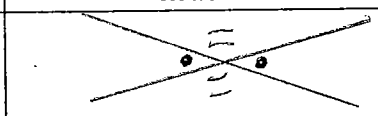
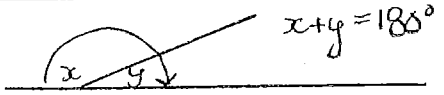
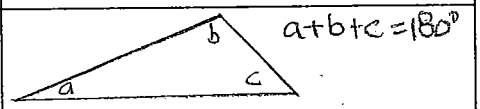
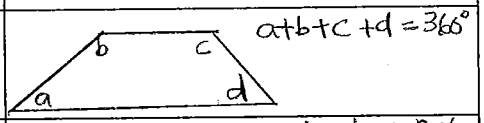
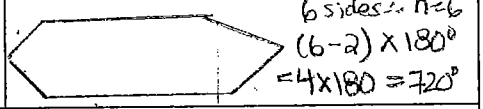
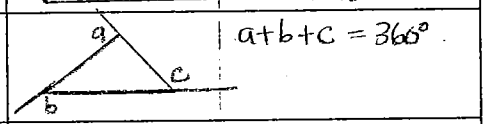
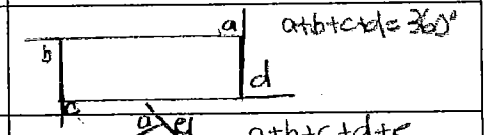
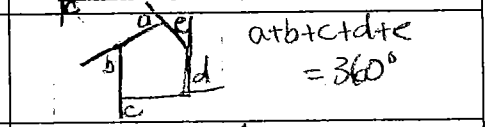
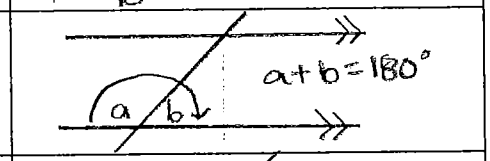
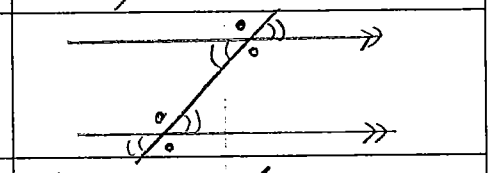
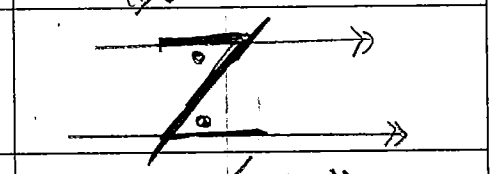
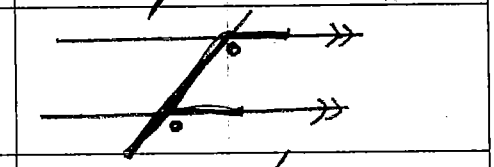
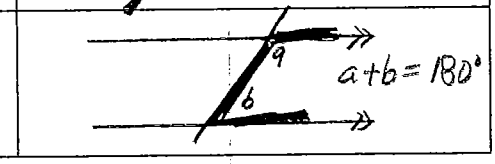
Maximum Area / Minimum Perimeter

- ✓ You are always looking for the dimension that will give you a square or as close to a square as possible.
- ✓ Dimensions are written as: ***length by width***

To calculate the dimensions that gives you the maximum area use: $side = \frac{Perimeter}{4}$	To calculate the dimensions that gives you the minimum perimeter use: $side = \sqrt{Area}$	To calculate the dimensions that gives you the maximum area if you only need to enclose 3 sides use: $length = \frac{Perimeter}{2}$ $\quad width = \frac{length}{2}$

Chapter #8 – Geometry

- A polygon is a closed figure that consists of line segments that only intersect at their endpoints.
- Parallel lines are lines that never touch and are usually identified with arrows on the lines that are parallel.
- Transversals are lines that touch/cross both parallel lines.

Concept	Explanation	Illustration
Opposite Angles	Are equal	
Straight Angles	Add to 180°	
Interior Angles of a Triangle	Add to 180°	
Interior Angles of a Quadrilateral	Add to 360°	
Interior Angles of any polygon "n-gon" Where n is the number of sides	$(n-2) \times 180°$	
Exterior Angles of a Triangle	Add to 360°	
Exterior Angles of a Quadrilateral	Add to 360°	
Exterior Angles of a "n-gon"	Add to 360°	
Supplementary Angles **(straight lines)**	Add to 180°	
Opposite Angles **(X pattern)**	Are equal	
Alternate Angles **(Z pattern)**	Are equal	
Corresponding Angles **(F pattern)**	Are equal	
Interior Angles **(C pattern)**	Add to 180°	

PRACTICE

1 Which of the following ratios is equivalent to 2:5?

a 5:2

b 2:7

c 14:35

d 22:25

2 The ratio of boys to girls in Mandy's mathematics class is 3 to 12.

This ratio is the same in Mandy's science class, in which there are 20 girls. How many boys are there in Mandy's science class?

a 5

b 8

c 11

d 15

3 Jake and Minh buy food for a fundraiser.

- One case of 24 hamburgers costs $37.
- One case of 12 drinks costs $9.

How much will the food for 72 meals cost if each meal is made up of 1 hamburger and 1 drink?

a $276

b $165

c $138

d $92

4 A school orders 120 calculators.
The school receives a shipment containing 80% of the order, and 1 out of every 3 of these calculators is black.
How many black calculators has the school received in this shipment?

a 32

b 40

c 50

d 96

5 What is the value of $-5 - (-3)$?

a -8

b -2

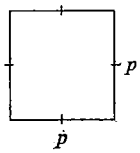
c 2

d 8

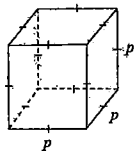
6 A line, square and cube are pictured below.

Line

Square



Cube



Which of the following statements describes one of the above?

a The length of the line is p^2.

b The area of the square is p^2.

c The volume of the cube is $3p$.

d The perimeter of the square is $2p$.

7 Which of the following is a simplified form of the expression below?

$$7(3x + 5)$$

a $56x$

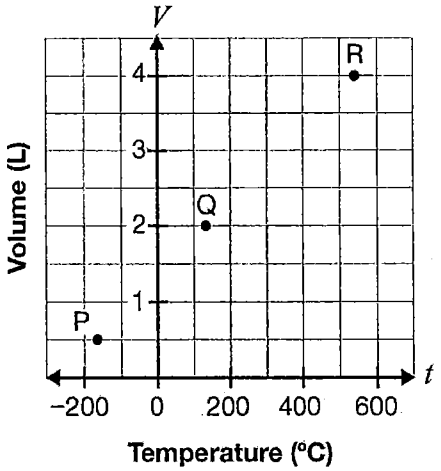
b $10x + 12$

c $21x + 5$

d $21x + 35$

8 Information about the volume of a particular gas and its temperature is shown on the graph.

Volume vs. Temperature



Which of the following is true about the information represented in this graph?

a The volume of the gas is less at R than at P.

b The volume of the gas is greater at Q than at R.

c The temperature of the gas is lower at P than at Q.

d The temperature of the gas is higher at Q than at R.

9 Each week, a salesperson is paid a base salary of \$250 plus \$100 for each car sold.

Which of the following shows information that is all correct about the salesperson's total pay for a week?

a

Number of cars sold	Total pay (\$)
1	250
4	650
5	750

b

Number of cars sold	Total pay (\$)
1	250
4	1000
5	1250

c

Number of cars sold	Total pay (\$)
1	350
4	650
5	750

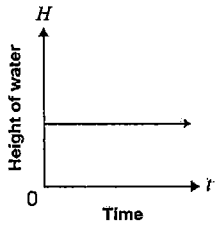
d

Number of cars sold	Total pay (\$)
1	350
4	1400
5	1750

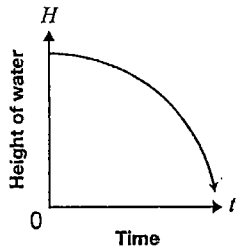
10 Rita measures the height of the water in a swimming pool as it is pumped out at a constant rate.

Which graph best represents the height of the water?

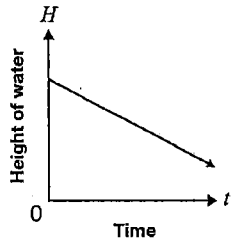
a



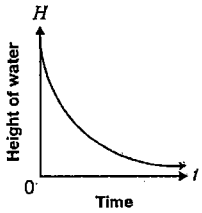
b



c



d



11 Use first differences to determine which table of values shows data from a linear relationship.

a

n	C
1	1
2	3
3	6
4	10

b

n	C
1	−1
2	−2
3	−1
4	−2

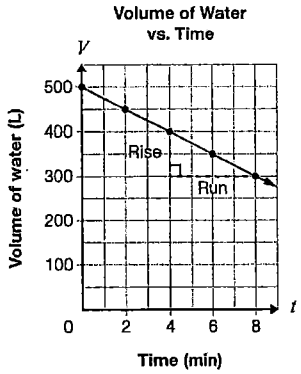
c

n	C
0	0
1	1
2	4
3	9

d

n	C
0	0
1	3
2	6
3	9

12 The graph below shows information about the linear relationship between the volume of water in a tank and time.



What is the rate of change in this relationship?

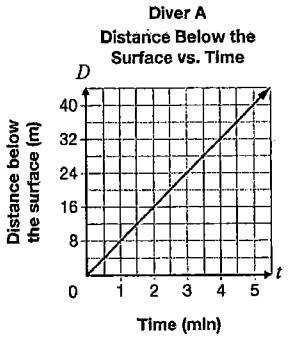
a −0.04 L/min

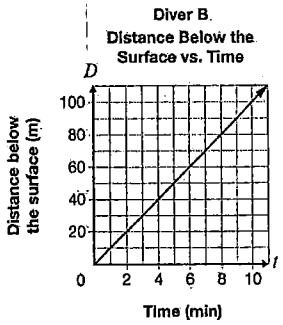
b −0.5 L/min

c −25 L/min

d −50 L/min

13 The relationship between the distance below the surface and time for two scuba divers is shown by the graphs below.





How much faster is diver B diving than diver A?

a 0 m/min

b 2 m/min

c 10 m/min

d 12 m/min

14 The equation $C = 45 + 3d$ represents the relationship between total cost, C, in dollars, and the number of days, d.

Which of the following is true about this relationship?

a The total cost is \$48 per day.

b The total cost is \$45 for 3 days.

c The total cost is made up of a \$45 fixed fee and \$3 per day.

d The total cost is made up of a \$3 fixed fee and \$45 per day.

15 The total cost of a cellphone plan, C, in dollars, is determined by the equation

$$C = 10 + 0.15n,$$

where n is the number of text messages sent.

If 25 text messages are sent, what is the total cost?

a \$13.75

b \$35.15

c \$100.00

d \$253.75

16 Amanda has a snow-shovelling business. Advertising costs her \$5 in total. She charges \$15 per driveway.
Which equation represents the relationship between her profit, P, and the number of driveways that she shovels, n?

a $P = 10n$

b $P = 20n$

c $P = 15n - 5$

d $P = 5n - 15$

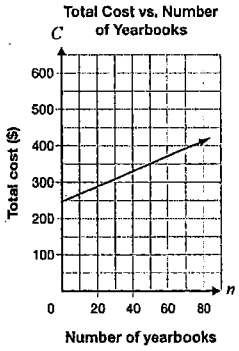
17 Last year's relationship between the total cost of producing yearbooks, C, and the number of yearbooks produced, n, is represented by the equation below.

$$C = 150 + 5n$$

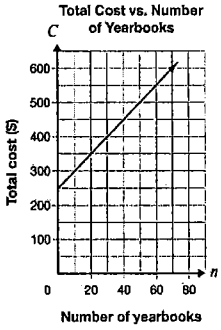
This year, the initial cost is increased but the cost per yearbook is decreased.

Which graph could represent this year's relationship between total cost and the number of yearbooks?

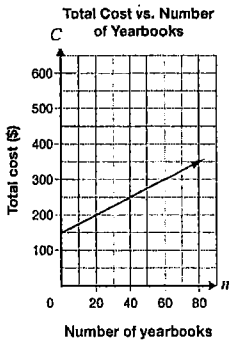
a



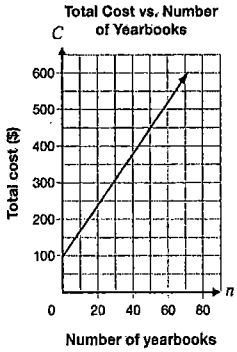
b



c

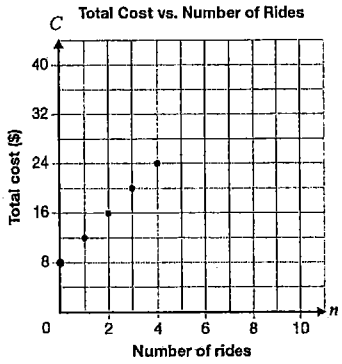


d



18 An amusement park has two options for rides.

- All-Day Pass: The total cost is \$36 for unlimited rides.
- Pay-as-You-Go: Information about the linear relationship between the total cost and the number of rides is shown on the graph.



Which of the following is a correct comparison of these two options?

a Pay-as-You-Go is cheaper for 8 rides.

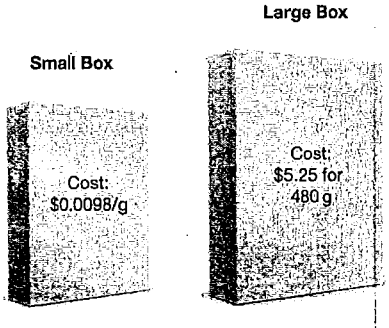
b The All-Day Pass is always more expensive.

c The All-Day Pass is cheaper if the number of rides taken is less than 6.

d Pay-as-You-Go is more expensive if the number of rides taken is more than 7.

19 Healthy Start

A grocery store sells Healthy Start cereal in two different sized boxes as shown below.



What is the difference in the cost of 100 g of cereal in these two boxes? Show your work.

20 Banking on a Car

Juan borrows money from his mom to buy a used car.

His mom uses the equation shown below to determine the number of monthly payments Juan will make to pay her back.

$$1.13T = 75n + d$$

In the equation,

- T represents the total cost of the car before tax, in dollars,
- n represents the number of monthly payments and
- d represents the amount of his down payment, in dollars.

How many monthly payments will Juan have to make to pay his mom back fully for a car that costs $2000 before tax with a down payment of $535?

Show your work.

21 Jar of Pennies

Sheldon creates a pattern by placing pennies in a jar. Each day he adds twice as many pennies as he did the day before.

- On Day 1, he places 1 penny in the jar.
- On Day 2, he adds 2 more pennies, for a total of 3 pennies in the jar.
- On Day 3, he adds 4 more pennies, for a total of 7 pennies in the jar.
- On Day 4, he adds 8 more pennies to the jar.

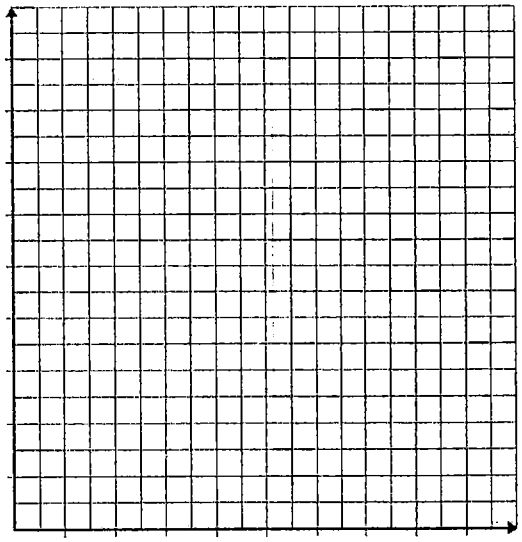
He continues adding pennies using this pattern. Complete the table of values with the total number of pennies in Sheldon's jar on Days 4 and 5.

Day	Total number of pennies in Sheldon's jar
1	1
2	3
3	7
4	
5	

Is the relationship between the total number of pennies in Sheldon's jar and the day number linear or non-linear?

Circle one: Linear Non-linear

Justify your answer. You may use the grid if you wish.



22 What a Haircut!

Cody gets a haircut. He measures the length of his hair as it grows back and discovers that it grows at a rate of 3 mm per week.
Complete the following table of values for the linear relation between the length of Cody's hair and the number of weeks since his last haircut.

Number of weeks since haircut	Length of hair (mm)
0	
1	4
2	
5	

State the rate of change and the initial value for this relationship.
Rate of change: _____

Initial value: _____

Write an equation to represent this linear relation, where L is the length of Cody's hair, in mm, and n is the number of weeks since his haircut.

$L =$ _____

23 Cellphone Plans

A company offers two different cellphone plans.
- Plan A: \$17 per month for the cellphone, plus \$0.25/min for additional talk time
- Plan B: \$20 per month for the cellphone, plus \$0.15/min for additional talk time
- Both plans include 200 minutes of talk time for free.

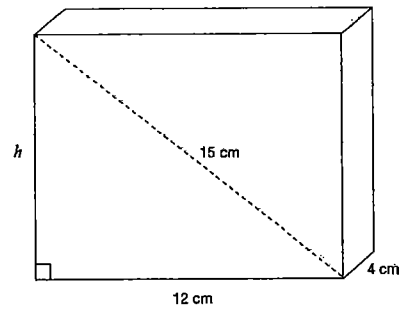
Determine the difference in total cost between the two cellphone plans for 237 minutes of talk time in one month. Show your work.

24 Picture of a Prism

Determine the volume of the rectangular prism pictured below.

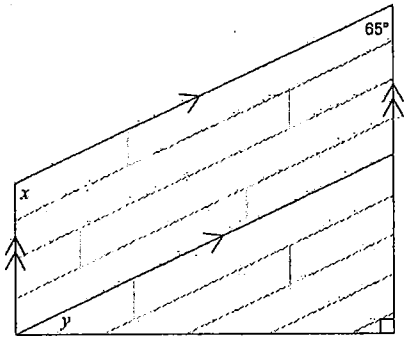
Show your work.

Hint:
Use the Pythagorean theorem as part of your solution process.



25 Delightful Deck

Ursula is building a deck. A view of the surface of the deck from above is pictured below.

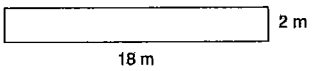


Complete the chart with the values of x and y. Justify your answers using geometric properties.

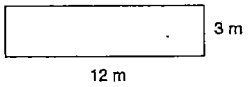
Value	Justification using geometric properties
$x =$ _____	
$y =$ _____	

26 Which rectangle below has the smallest perimeter?

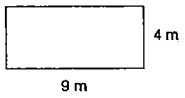
a



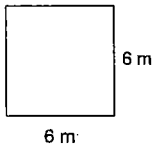
b



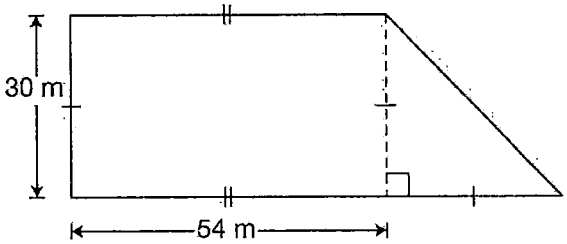
c



d



27 Jensen is seeding his lawn. The shape of his lawn is shown in the diagram below.



Each bag of grass seed covers 310 m^2.

What is the minimum number of bags of seed that Jensen will need to seed his entire lawn?

a 5

b 6

c 7

d 8

28 Tennis balls have a radius of 3.5 cm.

Which of the following is closest to the volume of 2 tennis balls?

a 88 cm^3

b 180 cm^3

c 359 cm^3

d 1078 cm^3

29 The Snack Company sells popcorn in 2 different-sized boxes. Each box is in the shape of a rectangular prism.

- Box A has dimensions 10 cm by 20 cm by 24 cm.
- Box B has dimensions 12 cm by 22 cm by 20 cm.

The price of the popcorn per cm^3 is the same for both boxes, and the price of each box is determined by the total volume of popcorn it can hold.

If Box A's price is \$6.24, what is the price of Box B?

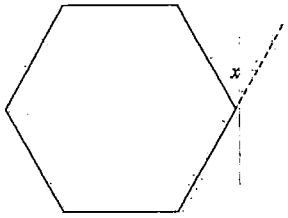
a \$5.67

b \$6.24

c \$6.86

d \$9.62

30 A regular hexagon with one side extended is shown.



What is the value of x?

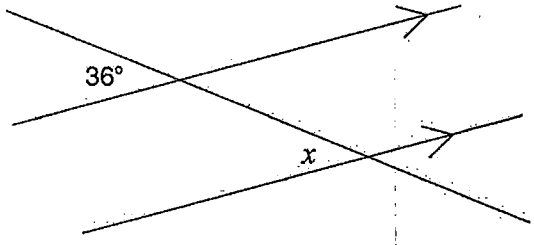
a 30°

b 60°

c 120°

d 240°

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



a 36°

b 54°

c 126°

d 144°

SOLUTIONS

1 Which of the following ratios is equivalent to 2:5?

~~a~~ 5:2

~~b~~ 2:7

(c) 14:35

d 22:25

$\times 7 \quad \times 7$
$2:5$
$= 14:35$

2 The ratio of boys to girls in Mandy's mathematics class is 3 to 12.

This ratio is the same in Mandy's science class, in which there are 20 girls. How many boys are there in Mandy's science class?

(a) 5

b 8

c 11

d 15

B:G
$3:12 = x:20$
$\frac{3}{12} = \frac{x}{20}$
$3(20) = 12x$
$60 = 12x$
$\frac{60}{12} = x$
$5 = x$

3 Jake and Minh buy food for a fundraiser.

- One case of 24 hamburgers costs \$37.
- One case of 12 drinks costs \$9.

How much will the food for 72 meals cost if each meal is made up of 1 hamburger and 1 drink?

a \$276

(b) \$165

c \$138

d \$92

1 hamburger cost: $\frac{37}{24} = \$1.54$
72 HB cost $= 1.54 \times 72 = \$111$
1 drink cost $\frac{9}{12} = \$0.75$ +
72 D's cost $= \$0.75 \times 72 = \$54$
$111 + 54 = \$165$

4 A school orders 120 calculators. The school receives a shipment containing 80% of the order, and 1 out of every 3 of these calculators is black.
How many black calculators has the school received in this shipment?

(a) 32

b 40

c 50

d 96

80% of 120
$\frac{80}{100} \times 120$
0.8×120
$= 96$ calculators

$\frac{1}{3}$ of total
$= \frac{1}{3} \times 96$
$= 0.33 \times 96$
$= 32$

5 What is the value of $-5 - (-3)$?

double signs

a –8

(b) –2

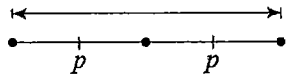
c 2

d 8

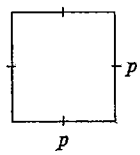
$-5 + 3$
$= -2$

6 A line, square and cube are pictured below.

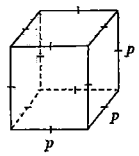
Line



Square



Cube



Which of the following statements describes one of the above?

~~a~~ The length of the line is p. (2) $= 2p$ perimeter is never $\square^2$

(b) The area of the square is p^2. $p \cdot p = p^2$ ✓

c The volume of the cube is $3p$. p^3

d The perimeter of the square is $2p$. $4p$

7 Which of the following is a simplified form of the expression below?

$7(3x + 5)$

a $56x$

b $10x + 12$

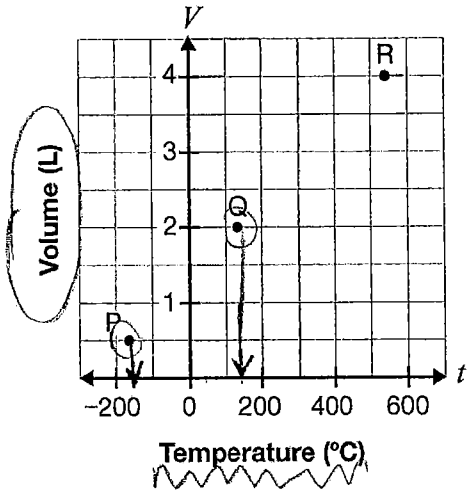
c $21x + 5$

(d) $21x + 35$

$7 \times 3 = 21$
$7 \times 5 = 35$
$21x + 35$

8 Information about the volume of a particular gas and its temperature is shown on the graph.

Volume vs. Temperature



Which of the following is true about the information represented in this graph?

this point is higher than P

a The volume of the gas is less at R than at P.

b The volume of the gas is greater at Q than at R. ✓

c The temperature of the gas is lower at P than at Q.

d The temperature of the gas is higher at Q than at R.

9 Each week, a salesperson is paid a base salary of $250 plus $100 for each car sold.

initial amount

slope

Which of the following shows information that is all correct about the salesperson's total pay for a week?

a

Number of cars sold	Total pay ($)
1	250
4	650
5	750

b

Number of cars sold	Total pay ($)
1	250
4	1000
5	1250

c

Number of cars sold	Total pay ($)
1	350 ✓
4	650 ✓
5	750

d

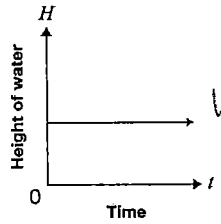
Number of cars sold	Total pay ($)
1	350 ✓
4	1400 X
5	1750

# of cars sold	Total pay
0	250
1	250 + 100 = 350
2	450
3	550
4	650

10 Rita measures the height of the water in a swimming pool as it is pumped out at a constant rate. This means we have a straight line

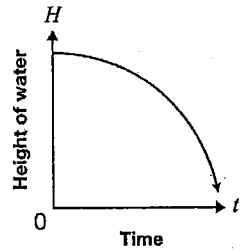
Which graph best represents the height of the water?

a

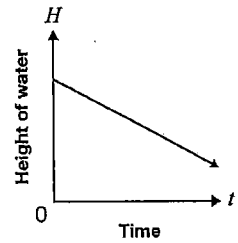


water level stays the same

b

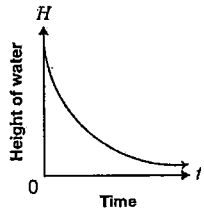


c



water is getting less out & constant rate

d



11 Use first differences to determine which table of values shows data from a linear relationship.

~~a~~

n	C
1	1
2	3
3	6
4	10

$3-1=2$
$6-3=3$

~~b~~

n	C
1	−1
2	−2
3	−1
4	−2

$-2--1 = -2+1 = -1$
$-1--2 = -1+2 = 1$

~~c~~

n	C
0	0
1	1
2	4
3	9

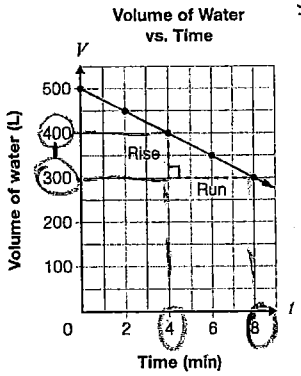
$1-0=1$
$4-1=3$

(d)

n	C
0	0
1	3
2	6
3	9

$3-0=3$
$6-3=3$
$9-6=3$
constant

12 The graph below shows information about the linear relationship between the volume of water in a tank and time.



*watch the scale on the graph

What is the rate of change in this relationship?

a −0.04 L/min

b −0.5 L/min

(c) −25 L/min

d −50 L/min

line is down & right
∴ slope is ⊖

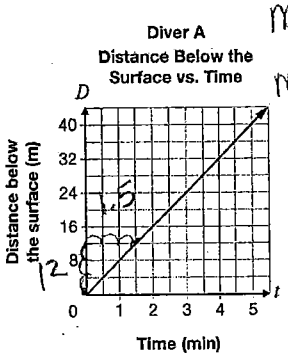
y values went from 400 to 300
∴ change in y = 100

x values went from 4 to 8 ∴ change in x = 4

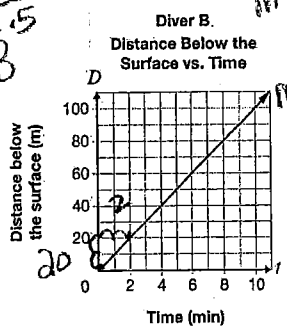
$m = \frac{-100}{4}$

$m = -25$ L/min

13 The relationship between the distance below the surface and time for two scuba divers is shown by the graphs below.



$m = \frac{12}{1.5}$
$m = 8$



$m = \frac{20}{2}$
$m = 10$

How much faster is diver B diving than diver A?

a 0 m/min

(b) 2 m/min

c 10 m/min

d 12 m/min

find the slope of each

B − A
10 − 8 = 2

14 The equation $C = 45 + 3d$ represents the relationship between total cost, C, in dollars, and the number of days, d.

Which of the following is true about this relationship?

~~a~~ The total cost is \$48 per day.

~~b~~ The total cost is \$45 for 3 days.

(c) The total cost is made up of a \$45 fixed fee and \$3 per day.

d The total cost is made up of a \$3 fixed fee and \$45 per day.

15 The total cost of a cellphone plan, C, in dollars, is determined by the equation

$$C = 10 + 0.15n,$$

where n is the number of text messages sent.

If 25 text messages are sent, what is the total cost?

(a) \$13.75

b \$35.15

c \$100.00

d \$253.75

$C = 10 + 0.15(25)$
$C = 10 + 3.75$

16 Amanda has a snow-shovelling business. Advertising costs her $5 in total. She charges $15 per driveway.
Which equation represents the relationship between her profit, P, and the number of driveways that she shovels, n?

slope

a $P = 10n$

b $P = 20n$

c $P = 15n - 5$

d $P = 5n - 15$

17 Last year's relationship between the total cost of producing yearbooks, C, and the number of yearbooks produced, n, is represented by the equation below.

initial amount

$$C = 150 + 5n$$

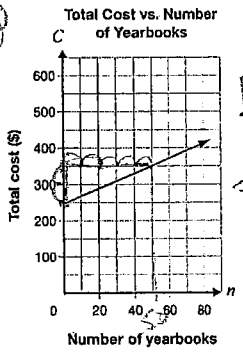
cost per yearbook

This year, the initial cost is increased but the cost per yearbook is decreased. must be bigger than 150

slope smaller than 5

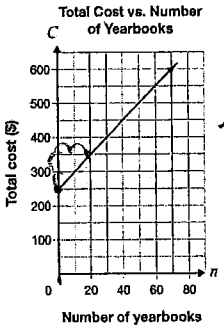
Which graph could represent this year's relationship between total cost and the number of yearbooks?

a



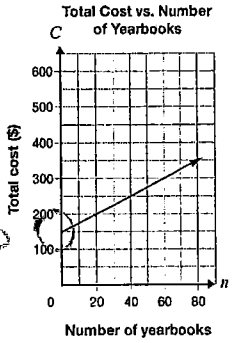
$\frac{100}{50} = 2$ less

b



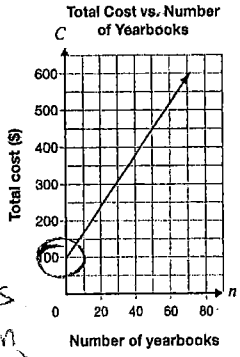
$\frac{100}{20} = 5$ same

c



= 150

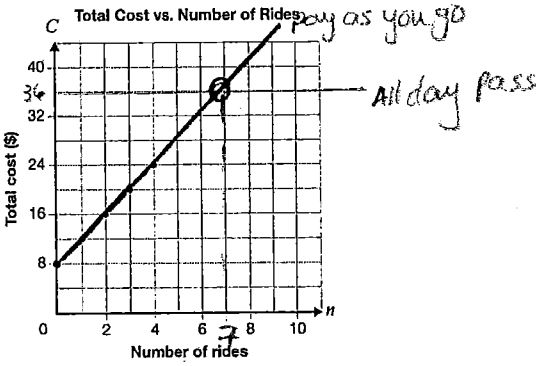
d



less than 150

18 An amusement park has two options for rides.

- All-Day Pass: The total cost is $36 for unlimited rides.
- Pay-as-You-Go: Information about the linear relationship between the total cost and the number of rides is shown on the graph.



Which of the following is a correct comparison of these two options?

a Pay-as-You-Go is cheaper for 8 rides.

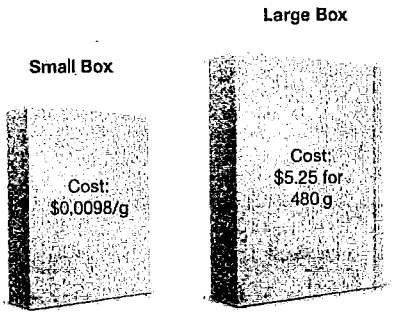
b The All-Day Pass is always more expensive.

c The All-Day Pass is cheaper if the number of rides taken is less than 6.

d Pay-as-You-Go is more expensive if the number of rides taken is more than 7.

19 Healthy Start

A grocery store sells Healthy Start cereal in two different sized boxes as shown below.



What is the difference in the cost of 100 g of cereal in these two boxes? Show your work.

Sm Box $0.0098/g × 100 = $0.98/100g.

Lrg Box $5.25/480g

$\frac{5.25}{480} = 0.0109/g \times 100$

$= \$1.09/100g$

$1.09 - 0.98 = \$0.11$

∴ It cost $0.11 less for 100g with the small box

20 Banking on a Car

Juan borrows money from his mom to buy a used car.

His mom uses the equation shown below to determine the number of monthly payments Juan will make to pay her back.

$$1.13T = 75n + d$$

In the equation,

- T represents the total cost of the car before tax, in dollars,
- n represents the number of monthly payments and
- d represents the amount of his down payment, in dollars.

How many monthly payments will Juan have to make to pay his mom back fully for a car that costs $2000 before tax with a down payment of $535?

Show your work.

Solving for "n" number of monthly payments.

$1.13T = 75n + d$

$T = 2000$

$n = ?$

$d = 535$

$1.13(2000) = 75n + 535$

$2260 = 75n + 535$

$2260 - 535 = 75n$

$1725 = 75n$

$\frac{1725}{75} = n$

$23 = n$

∴ It will take 23 monthly payments to pay his mom back.

21 Jar of Pennies

Sheldon creates a pattern by placing pennies in a jar. Each day he adds twice as many pennies as he did the day before.

- On Day 1, he places 1 penny in the jar.
- On Day 2, he adds 2 more pennies, for a total of 3 pennies in the jar.
- On Day 3, he adds 4 more pennies, for a total of 7 pennies in the jar.
- On Day 4, he adds 8 more pennies to the jar.

He continues adding pennies using this pattern. Complete the table of values with the total number of pennies in Sheldon's jar on Days 4 and 5.

Day	Total number of pennies in Sheldon's jar
1	1
2	+2 3
3	+4 7
4	+8 15
5	+16 31

3-1=2

7-3=4

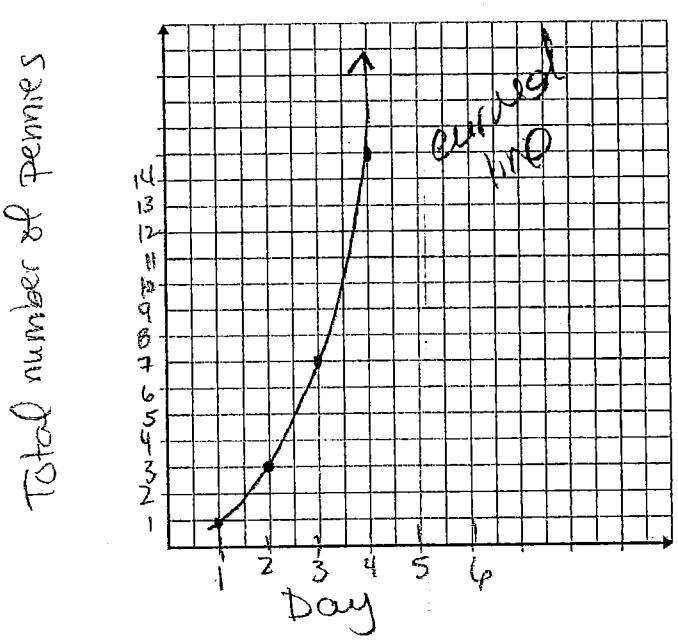
Is the relationship between the total number of pennies in Sheldon's jar and the day number linear or non-linear?

Circle one: Linear Non-linear

Justify your answer. You may use the grid if you wish.

Because 1st differences are not constant.

OR sketch



22 What a Haircut!

Cody gets a haircut. He measures the length of his hair as it grows back and discovers that it grows at a rate of 3 mm per week.
Complete the following table of values for the linear relation between the length of Cody's hair and the number of weeks since his last haircut.

Number of weeks since haircut	Length of hair (mm)
0	1
1	_+3 = 4
2	4+3 = 7
5	7+3 = 10

State the rate of change and the initial value for this relationship.
Rate of change: 3 mm/week

Initial value: 1mm

Write an equation to represent this linear relation, where L is the length of Cody's hair, in mm, and n is the number of weeks since his haircut.

$L =$ 3n + 1

23 Cellphone Plans

A company offers two different cellphone plans.
- Plan A: \$17 per month for the cellphone, plus \$0.25/min for additional talk time
- Plan B: \$20 per month for the cellphone, plus \$0.15/min for additional talk time
- Both plans include 200 minutes of talk time for free.

Determine the difference in total cost between the two cellphone plans for 237 minutes of talk time in one month. Show your work.

(A) $y = 0.25x + 17$

(B) $y = 0.15x + 20$

237 − 200 = 37 minutes

free

$y = 0.25(37) + 17$

$y = \$26.25$

$y = 0.15(37) + 20$

$y = \$25.55$

26.25 − 25.55 = \$0.70

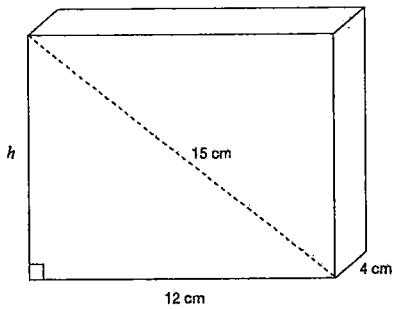
∴ Plan B is \$0.70 cheaper

24 Picture of a Prism

Determine the volume of the rectangular prism pictured below.

Show your work.

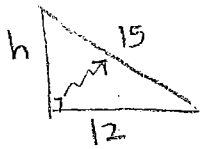
Hint:
Use the Pythagorean theorem as part of your solution process.



$V = l \cdot w \cdot h$

$V = (12)(4)h$

need to solve for this



$h^2 = 15^2 - 12^2$

$h^2 = 81$

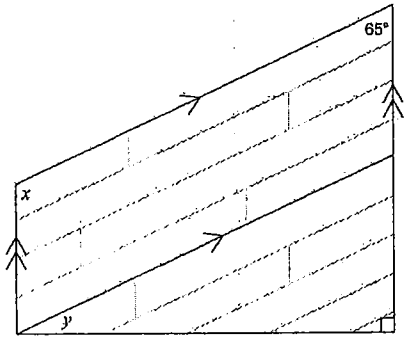
$h = \sqrt{81} = 9$

$V = (12)(4)(9)$

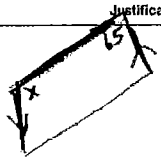
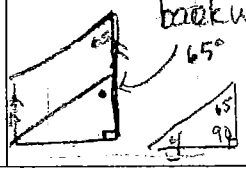
$V = 432$

25 Delightful Deck

Ursula is building a deck. A view of the surface of the deck from above is pictured below.

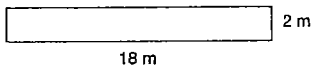


Complete the chart with the values of x and y. Justify your answers using geometric properties.

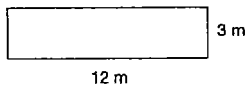
Value	Justification using geometric properties
$x =$ 115°	 C pattern x = 180 − 65 x = 115°
$y =$ 25°	 backwards f angles in a△ add to 180° y = 180 − 90 − 65 y = 25°

26 Which rectangle below has the smallest perimeter?

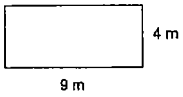
a



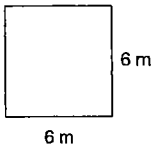
b



c

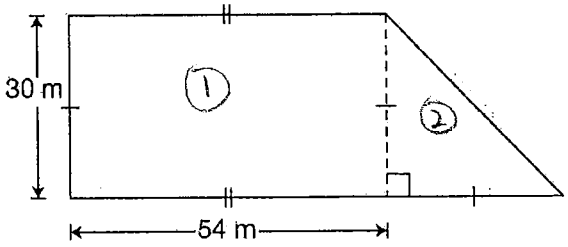


d



you want a SQUARE or add all outside lengths & see which total is smallest

27 Jensen is seeding his lawn. The shape of his lawn is shown in the diagram below.



Each bag of grass seed covers 310 m^2.

What is the minimum number of bags of seed that Jensen will need to seed his entire lawn?

a 5

b 6

c 7

d 8

$A_{①} = 54 \times 30 = 1620\ m^2$

$A_{②} = \frac{(30)(30)}{2} = 450\ m^2$

Total Area $= 1620 + 450$
$= 2070\ m^2$

# of bags $= 2070 \div 310 = 6.67$

28 Tennis balls have a radius of 3.5 cm.

Which of the following is closest to the volume of 2 tennis balls?

a 88 cm^3

b 180 cm^3

c 359 cm^3

d 1078 cm^3

$V = \frac{4\pi r^3}{3}$

$V = \frac{4(3.14)(3.5)^3}{3}$

$V = \frac{4(3.14)(42.875)}{3}$

$V = 179.5 \times 2 = 359.$

29 The Snack Company sells popcorn in 2 different-sized boxes. Each box is in the shape of a rectangular prism.

- Box A has dimensions 10 cm by 20 cm by 24 cm.
- Box B has dimensions 12 cm by 22 cm by 20 cm.

The price of the popcorn per cm^3 is the same for both boxes, and the price of each box is determined by the total volume of popcorn it can hold.

If Box A's price is \$6.24, what is the price of Box B?

a \$5.67

b \$6.24

c \$6.86

d \$9.62

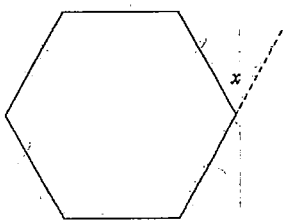
Ⓐ $V = 10 \times 20 \times 24$
$V = 4800\ cm^3$

$\frac{6.24}{4800} = 0.0013/cm$

Ⓑ $V = 12 \times 22 \times 20$
$= 5280$
$\times 0.0013$
$= \$6.86$

30 A regular hexagon with one side extended is shown.

6 sides
$\frac{360}{6} = 60°$



What is the value of x?

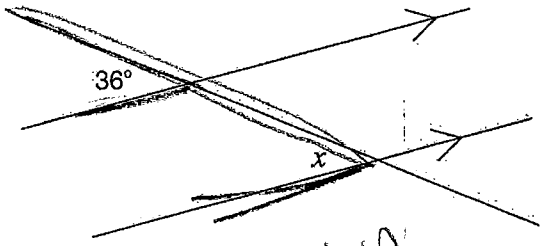
a 30°

b 60°

c 120°

d 240°

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



F pattern

a 36°

b 54°

c 126°

d 144°