Year 10 Term 2 Homework

Student Name: ______________	**Grade**: ______________
Date: ______________	**Score**: ______________

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2 Year 10 Term 2 Week 2 Homework

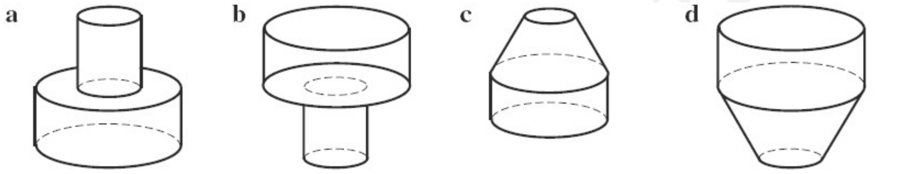
2.1 Graphs in the number plane

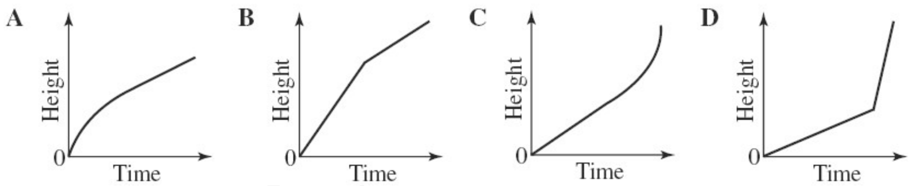
2.1.1 Graphs of physical phenomena

- If the graph is a straight line, then the rate of change is constant.
- If the graph is curved, then the rate of change is not constant.
- If the line of curve is increasing from left to right, then the dependent variables is increasing.
- If the line of curve is decreasing from left to right, then the dependent variable is decreasing.

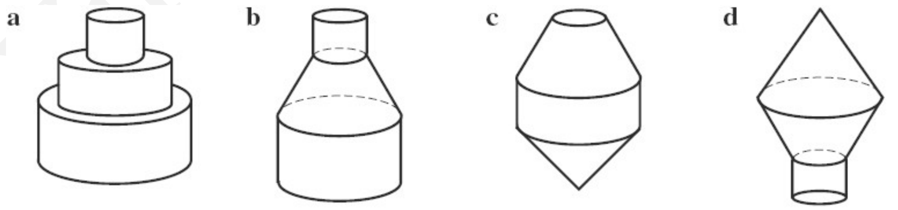
Exercise 2.1.1

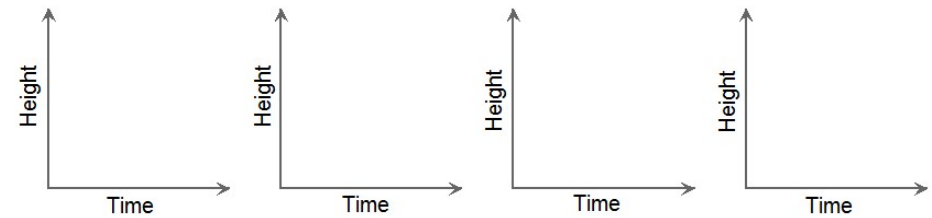
1. *The containers below are to be filled with water at a uniform rate. For each container, select the graph the best shows the change in the height of the water against time and justify your choice.*





2. *The containers below are to be filled with water at a constant rate. For each container, draw a graph that shows how the height of the water is changing with time.*

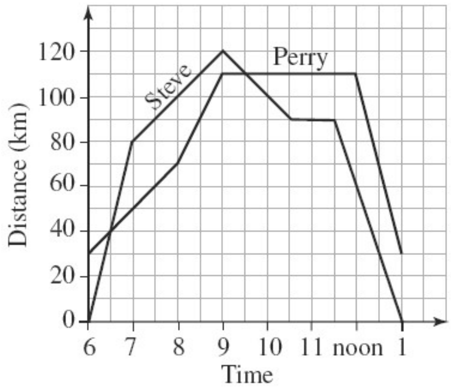




2.1.2 Travel graphs

- The slope of the line indicates the speed at which the object is moving.
- The steeper the line, the faster the speed. The flatter the line, the slower the speed.
- A horizontal line indicates that the object is stationary.
- Speed $= \frac{\text{distance}}{\text{time}}$, Distance $=$ speed $\times$ time, Time $= \frac{\text{distance}}{\text{speed}}$.

Exercise 2.1.2 Steve and Perry undertook separate journeys during the day. Both men began their journeys from home.



1. *How far apart do the men live?* ______________________
2. *At what time did their paths cross each other?* ______________________
3. *Who was travelling faster during the second hour?*

____

4. *How far apart were the men when Perry's speed first increasing?*

____

5. *How far has Perry travelled when Steve began his return trip?*

____

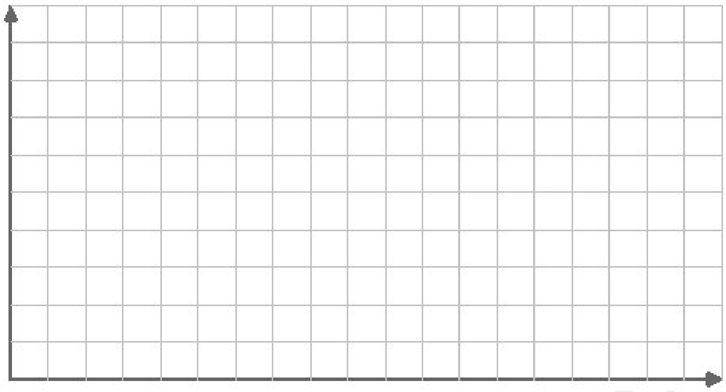
6. *Calculate the average speed for each man for their whole journey, correct to 2 decimal places.*

____

____

Exercise 2.1.3 Graham left home at 9 am. and drove to his friend's house, which is 90 km away. He reached the house at 11:00 am and stayed for two hours. He then drove for 30 minutes to the shopping centre, which was 15 km away, and spent half a hour buying groceries. Graham had lunch there for one hour then drove home at a speed of 50 km/h for $1\frac{1}{2}$ hours.

1. *Draw a travel graph to show Graham's trip.*



2. *At what speed did he drive on the way to his friend's house?*

3. *When did he leave the shopping centre?*

4. *At what time did Graham reach home after lunch?*

5. *At what times during the day was Graham was 60 km from home?*

6. *What was average speed for his whole journey?*

2.1.3 Straight line graphs

- The gradient-intercept form: $y = mx + b$, where **m** is the gradient and **b** is the y-intercept.
- The general form of the linear equation: $ax + by + c = 0$, where a, b, c are integers and $a > 0$.
- Parallel lines: If two lines have the same gradient we say that two lines are parallel.
- $x = a$ is the equation of a vertical line.
- $y = b$ is the equation of a horizontal line.
- A point lies on a line if its co-ordinates satisfy the equation of the line.

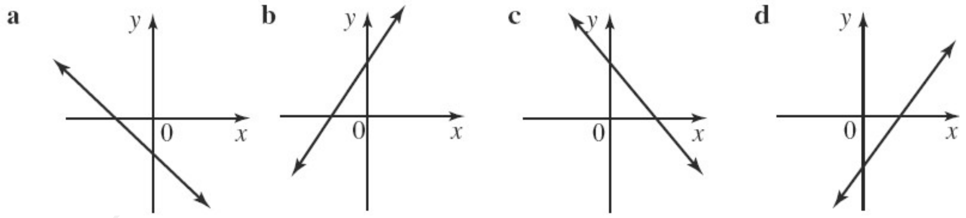
Exercise 2.1.4 Write each equation in the gradient-intercept form, then write down the gradient and y-intercept:

1. $3x + 4y + 16 = 0$

2. $6x - 2y - 1 = 0$

Exercise 2.1.5 Choose the equation that best describes each of the lines shown below:

- $y = 3x + 4$
- $y = 3x - 4$
- $y = 4 - 3x$
- $y = -3x - 4$



Exercise 2.1.6 Find the equation of the line that passes through each set of points:

a

x	0	1	2	3	4
y	7	8	9	10	11

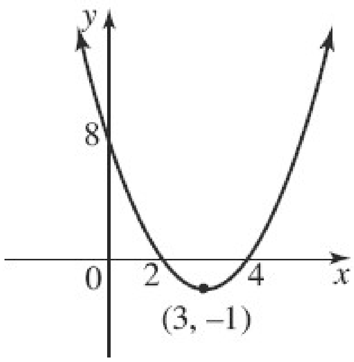
b

x	0	1	2	3	4
y	0	5	10	15	20

2.1.4 The parabola

- Equation of the parabola: $y = ax^2 + bx + c$
- The graph is a smooth curve.
- The curve is concave upward if $a > 0$
- The curve is concave downward if $a < 0$
- The axis of symmetry is $x = \frac{-b}{2a}$
- To find the y co-ordinate of the vertex, substitute $x = \frac{-b}{2a}$ in to the equation of the parabola.

Example 2.1.1 Consider the parabola with equation $y = x^2 - 6x + 8$. Find the x- and y-intercepts, the axis of symmetry and the vertex.



Solution: *When $x = 0$: $y = 0^2 - 6(0) + 8 = 8$*

$\therefore$ *The y-intercept is 8.*

When $y = 0$: $x^2 - 6x + 8 = 0$

$(x - 2)(x - 4) = 0$

$\therefore x = 2, 4$

$\therefore$ *The x-intercept are 2, 4.*

Note: In he equation, the co-efficient of x^2 is positive. Therefore, the curve is concave up.

Since the equation is $y = x^2 - 6x + 8$

$a = 1$, $b = -6$ *and* $c = 8$

$\therefore$ *The axis of symmetry of the curve is:*

$x = \frac{-b}{2a} = \frac{-(-6)}{2\times 1} = 3$

$y = (3)^2 - 6(3) + 8 = -1$

$\therefore$ *The co-ordinates of the vertex are* $(3, -1)$

Example 2.1.2 For the parabola with equation $y = -x^2 - 6x - 8$:

1. *Find the x-intercepts.*

   Solution: *When* $y = 0$

   $-(x^2 + 6x + 8) = 0$

   $-(x + 2)(x + 4) = 0$

   $\therefore x = -2, -4$

   $\therefore$ *The x-intercepts are -2, -4.*

2. *Find the y-intercepts.*

   Solution: *When* $x = 0$

   $y = -(0)^2 - 6(0) - 8 = -8$

   $\therefore$ *The y-intercept is -8.*

3. *Find the equation of the axis of symmetry.*

   Solution: $x = \frac{-b}{2a}$

   $\therefore x = \frac{-(-6)}{2\times(-1)} = -3$

4. *Find the coordinates of the vertex.*

   Solution: $y = -x^2 - 6x - 8$

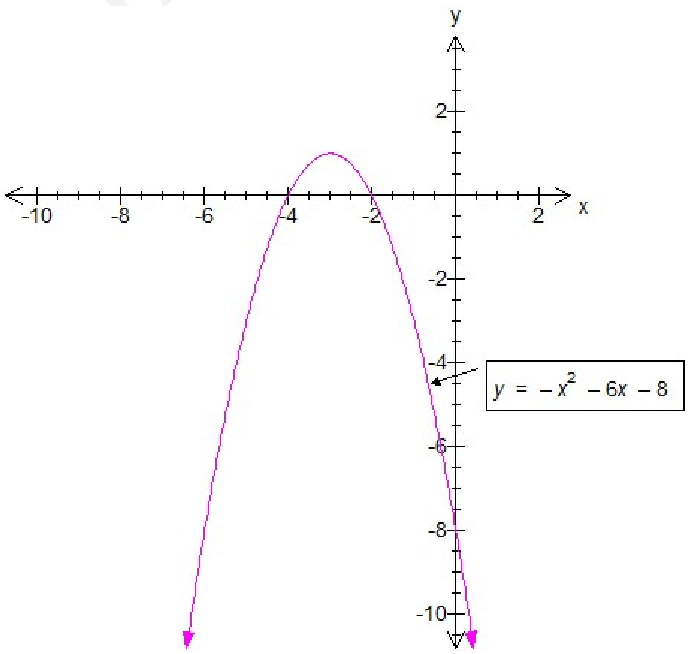
   Substitute $x = -3$

   $y = -(-3)^2 - 6(-3) - 8 = 1$

   $\therefore$ *The vertex is at (-3, 1)*

5. *Sketch the curve.*

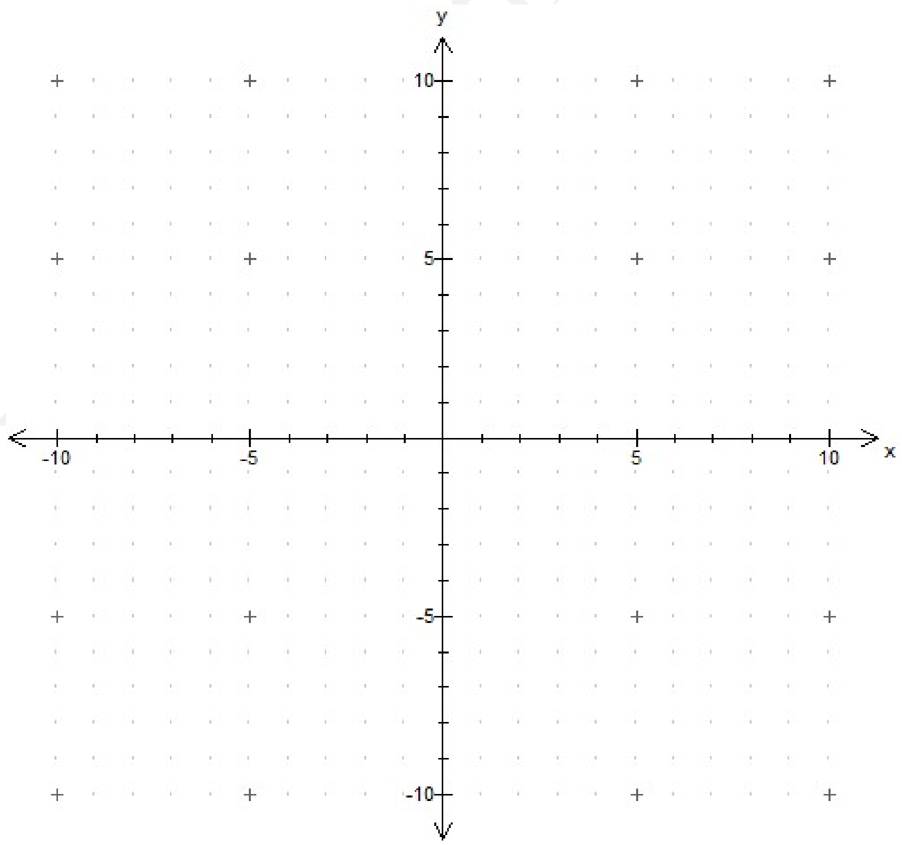
   The co-efficient of x^2 *is negative. Therefore the curve is concave down as shown below:*



Exercise 2.1.7

1. *Sketch the graph of* $y = (x - 1)(x - 5)$ *showing the x and y-intercepts and the vertex.*

2. *Hence, sketch the graph of* $y = 2(x - 1)(x - 5)$ *on the same number plane.*



2.1.5 Miscellaneous exercises

Exercise 2.1.8 Solve the following simultaneous equations

1. $5x + y = -6$
   $x + 2y = 24$

2. $3x - 4y = -11$
   $7x + 6y = -18$

Exercise 2.1.9

1. *Solve the equation by completing the square:* $5x^2 - 8x - 4 = 0$

2. *Solve the following quadratic equation:* $3x^2 - 2x - 5 = 0$

3. *Simplify the following:* $(5x + 2)^2 - (3 + x)(3 - x)$

Exercise 2.1.10 Simplify the following expressions:

1. $\frac{x^{-1}+y^{-1}}{x+y} - \frac{x^{-1}-y^{-1}}{x-y}$

2. $81^{2x+3} \div 243^{x-1}$

3. $(5x^{\frac{1}{4}}) \div (125x^3)^{\frac{1}{3}}$

Exercise 2.1.11 Solve these inequations:

1. $x - \frac{x}{3} > 4$

2. $\frac{4-3x}{3} \leq \frac{3x+4}{2}$

Exercise 2.1.12 Ben bought a car priced at $36,000 on terms. He paid a 12% deposit.

1. *Calculate the deposit paid.*

2. *Simple interest was charged on the balance at 7% per annum over four years. Calculate the total interest that he was charged.*

3. *What is the total amount that Ben paid for the car?*

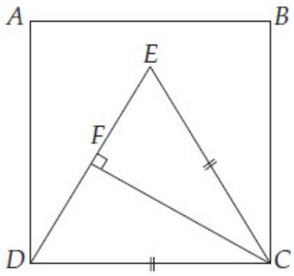
4. *Ben paid the balance plus interest in equal monthly instalments over four years. How much did he pay each month?*

Exercise 2.1.13

1. *A basketball count has a dimension 20 m by 10 m. A rectangular safety fence was built around the court 3.5 metres from all sides. A space of 2 metre was left for a gate. How long is the safety fence?*

2. *Ten minutes before the end of a practice game the score was Red team 12 goals, Blue team 14 goals. During the last ten minutes 16 goals were scored. The Red team won by 4 goals. How many goals did the Red team score in the last ten minutes?*

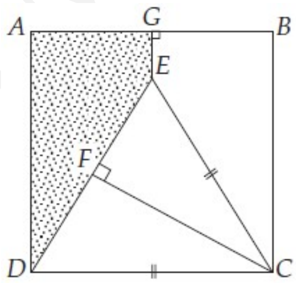
Exercise 2.1.14 ABCD is a square. $\triangle DEC$ is an equilateral triangle. $EC = 8\,cm$. $CF \perp DE$. F is the midpoint of DE.



1. *Use Pythagoras' theorem to find the length of FC (correct to 2 decimal place).*

2. *Calculate the area of the $\triangle CDE$.*

3. *The line GE is added to the G diagram so that $GE \perp AB$.*



   (a) *Find the length of GE.*

   (b) *Calculate the shaded area.*