Paper 1 Revision

1 Factors

1.1 Highest Common Factor

Factorise the following expressions:

1. $3a + 6b$
2. $x^2 - 5x$
3. $4p^2 - 6p$
4. $ax^2 + ax$
5. $7x^2 - 14x + 21xy$
6. $ab + ac + a$
7. $xy - 2x^2y + 3xy^2$

1.2 Grouping

1. $ab + ac + db + dc$
2. $xy + wy + xz + wz$
3. $p^2 + pq + pr + qr$
4. $pq - 3py + rq - 3ry$
5. $6xy - 3ay + 10bx - 5ab$
6. $20ax - 8bx + 5ay - 2by$
7. $p^2 - 6q + 3p - 2pq$
8. $xy - 4z - 4x + yz$
9. $3ab + 4xy - 6bx - 2ay$

1.3 Quadratic Trinomials

1. $x^2 + 7x + 12$
2. $x^2 + 8x + 15$
3. $x^2 - 8x + 12$
4. $x^2 - 10x + 21$
5. $x^2 - 4x - 21$
6. $x^2 - x - 12$
7. $x^2 - x - 20$
8. $2x^2 + 5x + 3$
9. $2x^2 - 7x + 6$
10. $2x^2 - 9x - 5$
11. $6x^2 - x - 2$
12. $8x^2 + 6x - 5$
13. $10x^2 - x - 3$

1.4 Difference of 2 Squares

1. $x^2 - y^2$
2. $a^2 - 16b^2$
3. $9m^2 - 49n^2$
4. $100x^2 - 1$
5. $64a^2 - 25b^2$

1.5 Factors Mix

1. **(2016 P1 Q11)**
   i. $25x^2 - 49n^2$
   ii. $2x^2 - 9x - 18$

2. **(2015 P1 Q7)**
   Factorise fully $ac - ad - bd + bc$

3. **(2015 P1 Q9)**
   Factorise $x^2 + 7x - 30$

4. **(2015 P1 Q12)**
   Factorise $n^2 - 1$

5. **(2014 P1 Q4)**
   (a) Factorise fully $9a^2 - 6ab + 12ac - 8bc$
   (b) Factorise fully $9x^2 - 16y^2$
   (c) Use factors to simplify the following: $\dfrac{2x^2 + 4x}{2x^2 + x - 6}$

6. **(2012 P1 Q11)** Factorise fully each of the following expressions:
   i. $5x^3 - 10x^2$
   ii. $4x^2 - 81y^2$
   iii. $a^2 - ab + 3a - 3b$

2 Quadratic Equations

Sovle the following quadratic equations.

1. (i) $x^2 + 7x - 30 = 0$ **(2015 P1 Q9)**
   (ii) $2x^2 + 5x + 2 = 0$
   (iii) $x^2 - x = 0$
   (iv) $x^2 - 1 = 0$
   (v) $2x^2 + 10x - 28 = 0$
   (vi) $x^2 - 5x - 6 = 0$ **(2012 P1 Q12)**
   (vii) $4x^2 - 9 = 0$
   (viii) $6x^2 - 8x = 0$
   (ix) $3x^2 + 11x = 4$ **(2013 P1 Q8)**
   (x) $8x^2 - 14x + 3 = 0$ **(2012 P1 Q12)**
   (xi) $2x^2 - 4x = 0$

2. Solve the following quadratic equations expressing your answer to the nearest two decimal places.
   (i) $x^2 - 4x - 8 = 0$
   (ii) $2x^2 - 7x - 10 = 0$ **(2015 P1 Q9)**
   (iii) $2x^2 - 7x - 6 = 0$ **(2012 P1 Q12)**
   (iv) $3x^2 - 10x + 5 = 0$

2.1 Context and Applications

In the following questions, create a quadratic equation based on the information given, and then solve the equation you have created.

1. A number is squared and added to 4 times the number to give a result of 12. What are two possible values for the number?

2. The square of a number minus 3 times the number gives a total of 18. What are two possible values for the number?

3. Two consecutive positive numbers are such that their product is 20. What are the two numbers?

4. Two consecutive positive even numbers have a product of 48. What are the two numbers?

5. A rectangle is such that the length is 4 cm more than the width. If the area of the rectangle is 21 cm^2, what is the length and width?

6. **(2014 P1 Q11)** x is a real number.
   One new number is formed by increasing x by 1.
   A second new number is formed by decreasing x by 2.
   i. Write down each of these new numbers in terms of x.
   Increase x by 1:
   Decrease x by 2:
   ii. The product of these two new numbers is 1.
   Use this information to write an equation in x.
   iii. Solve this equation to find the two possible values of x.
   Give each of your answers correct to 3 decimal places.

7. **(2016 P1 Q12)** Three bags are shown in the table below. The mass of each bag (in kg) is also shown.

Bag			
Mass, in kg ($y \in \mathbb{R}$)	$y+5$	19	$2y^2+1$

Two of the bags have the same mass (in kg).

(a) Find the **three** possible positive values of y.
Give your irrational answer correct to two decimal places.

(b) Explain why all three bags can **not** have the same mass (in kg).

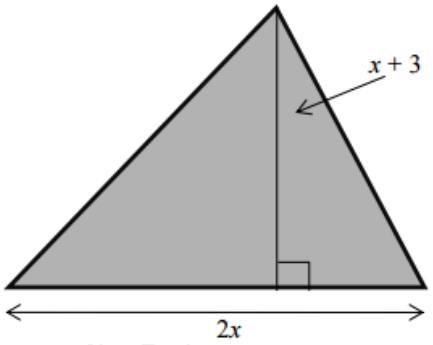
8. **(2015 P1 Q12)**

   (a) i. Factorise $n^2 - 1$.

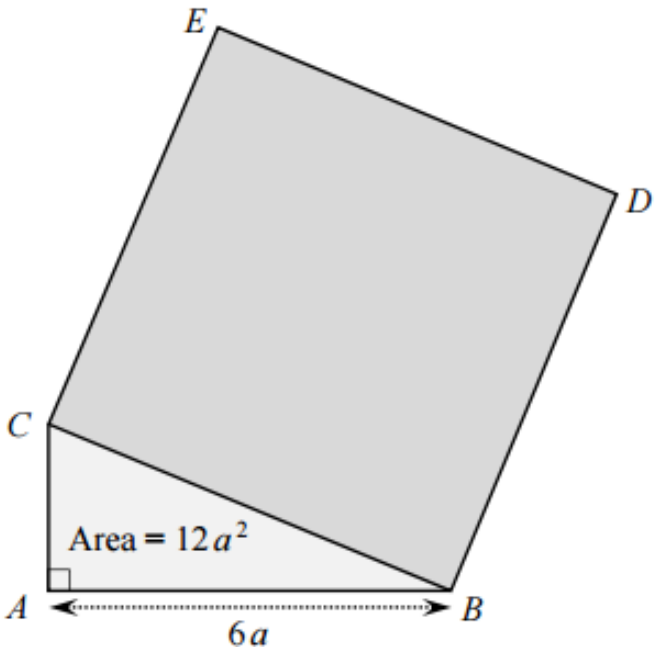
   ii. Hence or otherwise, answer the following question.
   The **product** of two **consecutive odd** positive numbers is 399. Find the two numbers.

9. **(2012 P1 Q10)**

   A triangle has a base length of $2x$ and a perpendicular height of $(x + 3)$ cm.
   The area of the triangle is 10 cm^2. Find the distance x.

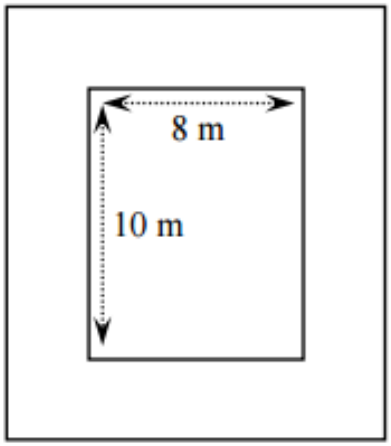


10. **(2016 P1 Q13)** The right angled triangle ABC is shown in the diagram below.
    The square $BDEC$ is placed on the hypotenuse of this triangle.
    The **area** of the **triangle** ABC is $12a^2$ square units, where $a \in R$.
    The **length** of the side $[AB]$ is $6a$ units.



Find the **area** of the **square** $BDEC$, in terms of a^2.

11. **(2015 Sample P1 Q9)**



A plot consists of a rectangular garden measuring 8m by 10m, surrounded by a path of constant width, as shown in the diagram.
The total are of the plot (garden and path) is 143 m^2.
Three students, Kevin, Elaine, and Tony, have been given the problem of trying to find the width of the path. Each of the is using a different method, but all of them are using x to represent the width of the path.

Kevin divides the path into eight pieces. He writes down the area of each piece in terms of x. He then forms an equation by setting the area of the path plus the area of the garden equal to the area of the total plot.

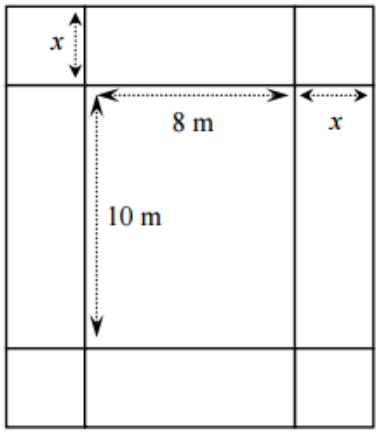
(a) Write, in terms of x, the area of each section into Kevin's diagram below.

(b) Write down and simplify the equation that Kevin should get. Give your answer in the form $ax^2 + bx + c = 0$.

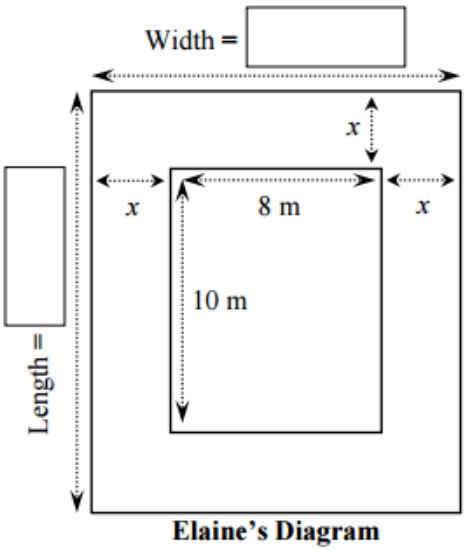
(c) Elaine writes down the length and width of the plot in terms of x.
She multiplies these and sets the answer equal to the area of the plot.
Write, in terms of x, the length and width of the plot in the space on Elaine's diagram.

(d) Write down and simplify the equation that Elaine should get. Give your answer in the form $ax^2 + bx + c = 0$.

(e) Solve the equation to find the width of the path.



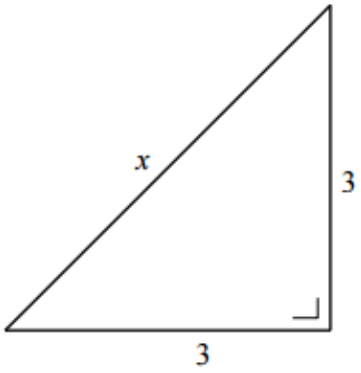
Kevin's Diagram



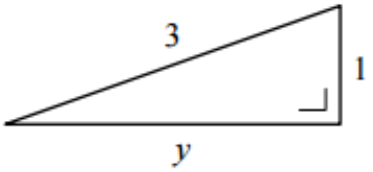
Elaine's Diagram

12. **(2014 P1 Q13)**

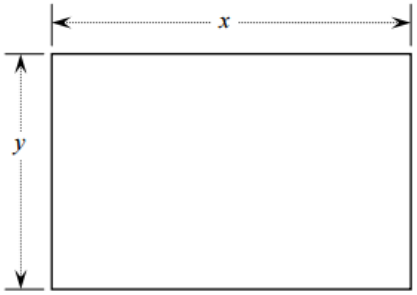
i. Use the diagram on the right to calculate the value of x.
Give your answer in surd form



ii. Use the diagram on the right to calculate the value of y.
Give your answer in surd form



iii. A rectangle with sides of length x and y is drawn using the values of x and y from parts **(i)** and **(ii)**, as shown below.
Write the **perimeter** of this rectangle in the form $a\sqrt{2}$, where $a \in N$.



3 Simultaneous Equations

1. $x + y = 3$
   $3x - 2y = 4$

2. $4x + 3y = 7$
   $7x + 2y = -4$

3. $2x - 3y = 18$
   $5x + 9y = -10$ **(2014 P1 Q12)**

3.1 Context and Applications

In the following questions, create simultaneous equations based on the given information, then solve the equations you have created.

1. One number added to twice another number is 7. Three times the first number minus the second number is also 7. Find the two numbers.

2. 2 bars and three drinks costs €5.40. One bar and one drink costs €2.10. What is the price of a bar? What is the price of a drink?

3. **(2013 P1 Q8)**
   A company employs two drivers, John and David. Each has use of a company car and small van. The company buys €30 worth of Toll Tags for each driver. Each time that a vehicle goes through the M50 Toll, a charge will be deducted from the Toll Tags.
   John goes through the M50 toll five times in his car and four times in his small van. He then has €7.90 **remaining** on his Toll Tags. David goes through the M50 toll twice in his car and six times in his small van. He then has €8.40 **left** on his Toll Tags.
   Calculate how much it costs for a car and for a small van to go through the M50 Toll.

4 Patterns

1. Analyse the following sequences, and comment on whether each sequence is linear, quadratic or exponential.
   i. 2,5,8,11,14.....
   ii. 1,4,9,16,25,.....
   iii. 2,4,8,16,32.....
   iv. 3,6,9,12,15.....
   v. 3,9,27,81.....
   vi. 2,5,10,17,26.....

4.1 Linear Patterns

2. Consider the following sequence: 2,5,8,11,14.....
   i. Show that the sequence is linear.
   ii. Find an expression for the n^{th} term.
   iii. What is the value of the 15th term of the sequence?
   iv. Which term of the sequence has a value of 47?

3. Consider the following sequence: 3,7,11,15,19.....
   i. Show that the sequence is linear.
   ii. Find an expression for the n^{th} term.

iii. What is the value of the 28th term of the sequence?

iv. Which term of the sequence has a value of 99?

4. Consider the following sequence: 5,7,9,11,13.....

   i. Show that the sequence is linear.

   ii. Find an expression for the n^{th} term.

   iii. What is the value of the 12th term of the sequence?

   iv. Which term of the sequence has a value of 77?

5. Consider the following sequence: 10,7,4,1,-2.....

   i. Show that the sequence is linear.

   ii. Find an expression for the n^{th} term.

   iii. What is the value of the 20th term of the sequence?

   iv. Which term of the sequence has a value of -17?

4.2 Quadratic Patterns

6. Consider the following sequence: 1,4,9,16,25.....

   i. Show that the sequence is quadratic.

   ii. Calculate the next 3 terms of the sequence.

7. Consider the following sequence: 3,9,19,33,51.....

   i. Show that the sequence is quadratic.

   ii. Calculate the next 3 terms of the sequence.

8. Consider the following sequence: 3,8,15,24,35.....

   i. Show that the sequence is quadratic.

   ii. Calculate the next 3 terms of the sequence.

9. Consider the following sequence: 3,10,21,36,55.....

   i. Show that the sequence is quadratic.

   ii. Find an expression for the n^{th} term.

   iii. What is the value of the 7th term of the sequence?

10. Consider the following sequence: 4,9,16,25,36.....

    i. Show that the sequence is quadratic.

    ii. Find an expression for the n^{th} term.

    iii. What is the value of the 13th term of the sequence?

4.3 Context and Applications

1. **(2014 P1 Q8)** The table shows the height, in metres, of a ball at various times after being kicked into the air.

   i. Is the pattern of heights in the table linear, quadratic or exponential? Explain your answer.

Time (seconds)	0	0·5	1	1·5	2	2·5	3
Height (metres)	0·3	3·4	5·7	7·2	7·9	7·8	6·9

   ii. Estimate the height of the ball after 3.5 seconds.

   iii. Estimate the total time the ball spends in the air. Justify your answer.

2. **(2012 P1 Q7)** Lisa is on a particular payment plan called "Plan A" for her electricity. She pays a standing charge each month even if no electricity is used. She also pays a rate per unit used. The table shows the cost, including the standing charge, of using different amounts of units, in a month.

Units Used	Plan A Cost in euro
100	38
200	56
300	74
400	92
500	110
600	128
700	146
800	164

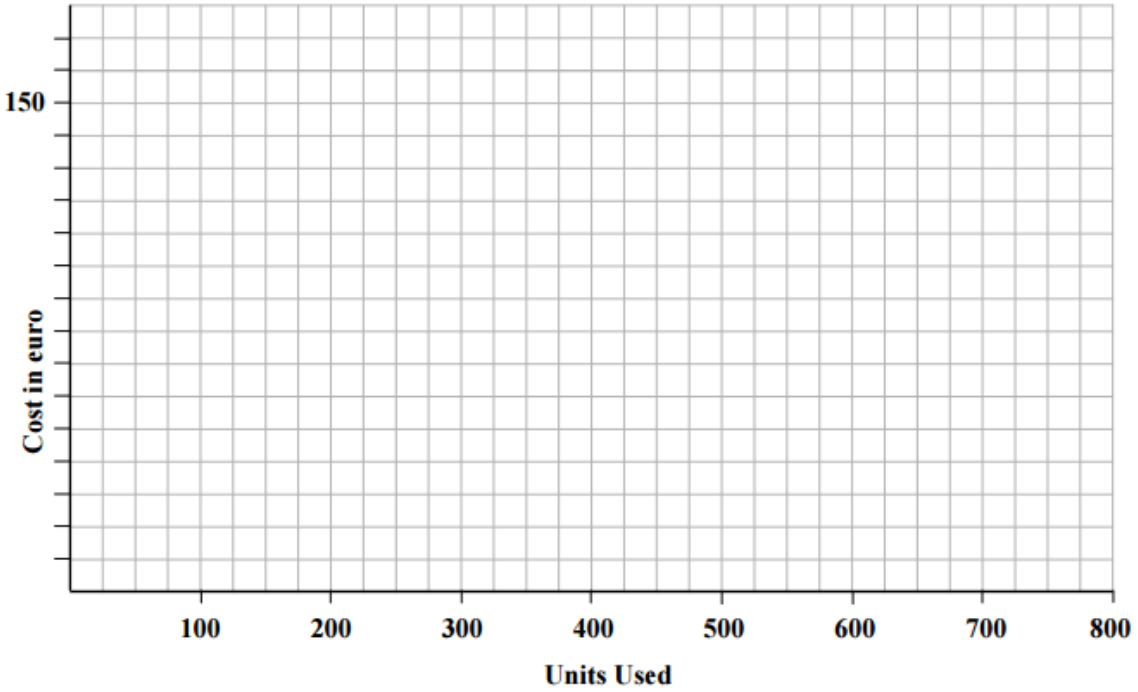
   (a) Use the data in the table to show that the relationship between the number of units used and the cost is linear.

   (b) Draw a graph to show the relationship between the number of units used and the cost of electricity.(Draw graph in space provided on next page!)

   (c) Use your graph to estimate the standing charge.

   (d) Write down a different method of finding the standing charge.
   Find the standing charge using your method.

   (e) Write down a formula to represent the relationship between the number of units used and the cost for any given number of units.



(f) The table above does not include VAT. One month Lisa used 650 units. Her total bill for that month, including VAT, was €155.50. Find the VAT rate on electricity, correct to one decimal places.

(g) Lisa is offered a new plan, "Plan B", where the standing charge is €36 and the rate per unit used is 15.5 cent. Complete the following table for Plan B.

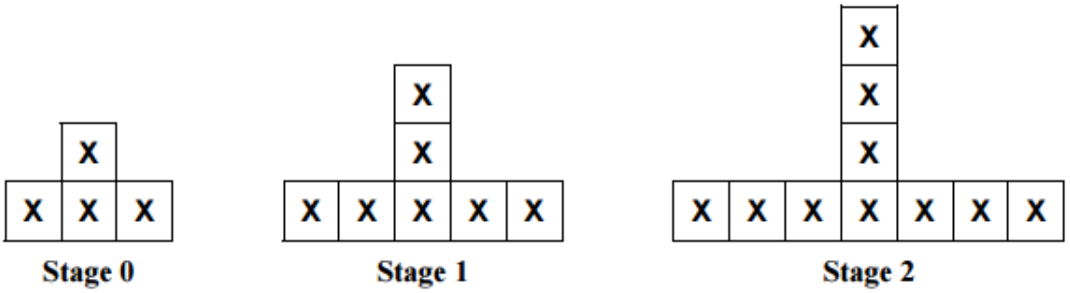
Units Used	Plan B Cost in euro
100	
200	
300	
400	
500	
600	
700	
800	

(h) Which plan do you think Lisa should choose? Give a reason for your answer.

(i) On your diagram for part **(b)**, draw a graph to show the relationship between the number of units used and the cost of electricity for Plan B. Label this graph "Plan B".

(j) Use your diagram to find the number of units for which both plans have the same cost.

3. **(2016 P1 Q8)** John makes a sequence where each stage is made up of a certain number of **X**s arranged in a pattern. The first three stages of John's sequence are shown below.
The sequence starts at **stage 0**.



(a) Draw the next stage of John's sequence.

(b) Using a table, a graph, or otherwise, write a formula to express N in terms of S, where N is the number of **X**s in stage S of John's sequence.

(c) There are exactly 130 **X**s in stage k of John's sequence. Find the value of k.

(d) Yoko is also making a sequence, with each stage made up of a certain number of **X**s arranged in a pattern. In Yoko's sequence, the relationship between N and S is given by the formula:

$$N = 1 + 2S$$

i. Draw one possible example of the first three stages of Yoko's sequence in the table below.

Yoko's sequence		
Stage 0	**Stage 1**	**Stage 2**

ii. p represents the number of **X**s in stage y of Yoko's sequence.
Write down the number of **X**s in stage $y + 3$ of Yoko's sequence.
Give your answer in terms of p.

5 Functions

5.1 Introduction to Quadratic Functions

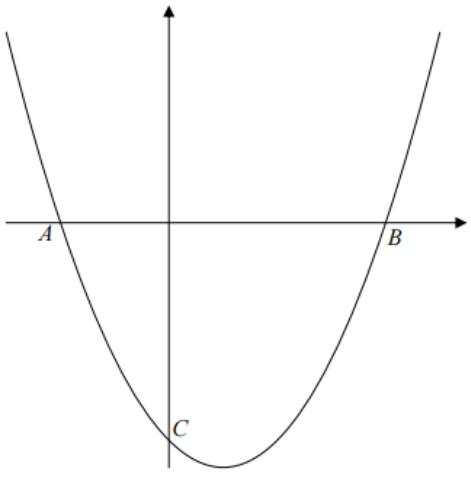
1. $f(x) = x^2 - 3x - 18$
   (a) What are the roots of $f(x) = 0$?
   (b) What is the value of $f(0)$?
   (c) Draw a sketch of $f(x)$, illustrating where the function crosses the horizontal and vertical axes.

2. $h(x) = x^2 - 4x$
   (a) What are the roots of $h(x) = 0$?
   (b) What is the value of $h(0)$?
   (c) Draw a sketch of $h(x)$, illustrating where the function crosses the horizontal and vertical axes.

3. $f(x) = 4x^2 - 9$
   (a) What are the roots of $f(x) = 0$?
   (b) What is the value of $f(0)$?
   (c) Draw a sketch of $f(x)$, illustrating where the function crosses the horizontal and vertical axes.

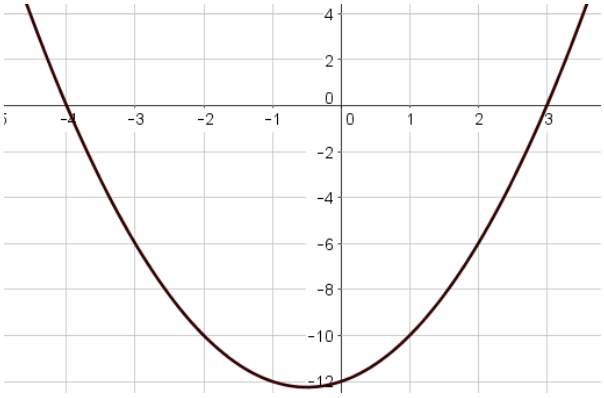
4. $g(x) = 2x^2 - 9x - 18$
   (a) What are the roots of $g(x) = 0$?
   (b) What is the value of $g(0)$?
   (c) Draw a sketch of $g(x)$, illustrating where the function crosses the horizontal and vertical axes.

5. **(2012 P1 Q14)** The diagram shows part of the graph of the function $f : x \to x^2 - 2x - 8$



   i. Find the co-ordinates of A, B and C.
   ii. Hence, write down the range of values of x for which $x^2 - 2x - 8 \leq 0$

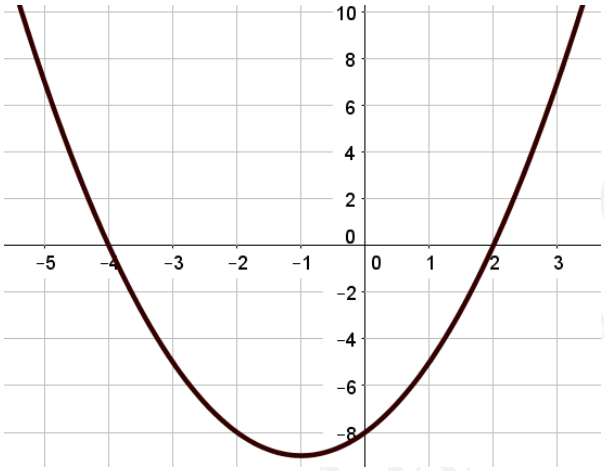
6. $f(x)$



(a) By examining the graph of $f(x)$ on the left, identify the roots of $f(x) = 0$.

(b) Hence find the equation of $f(x)$.

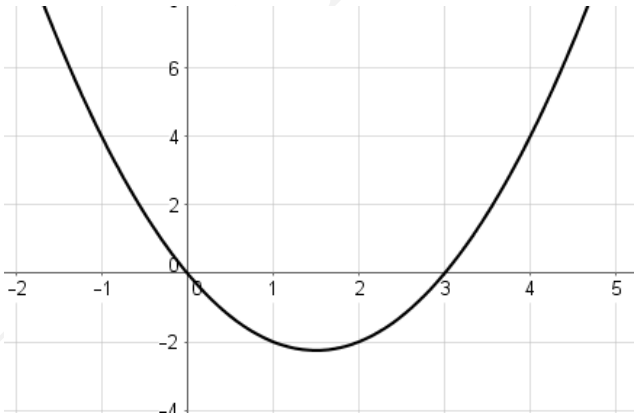
7. $g(x)$



(a) By examining the graph of $g(x)$ on the left, identify the roots of $g(x) = 0$.

(b) Hence find the equation of $g(x)$.

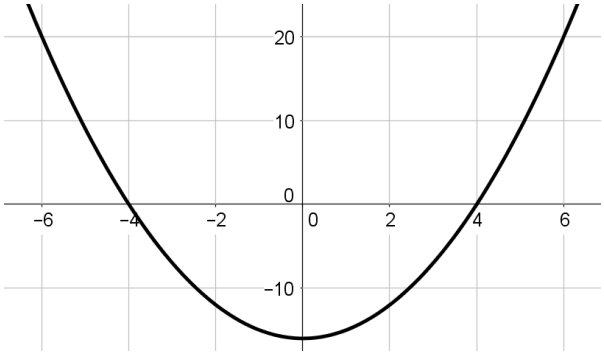
8. $h(x)$



(a) By examining the graph of $h(x)$ on the left, identify the roots of $h(x) = 0$.

(b) Hence find the equation of $h(x)$.

9. $f(x)$

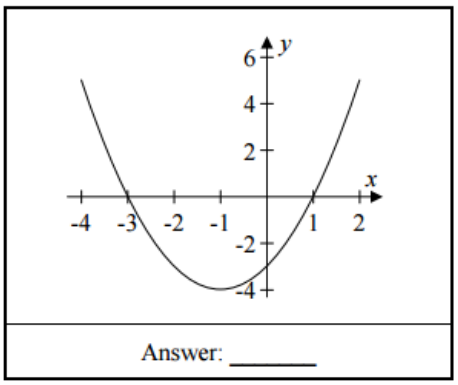


(a) By examining the graph of $f(x)$ on the left, identify the roots of $f(x) = 0$.

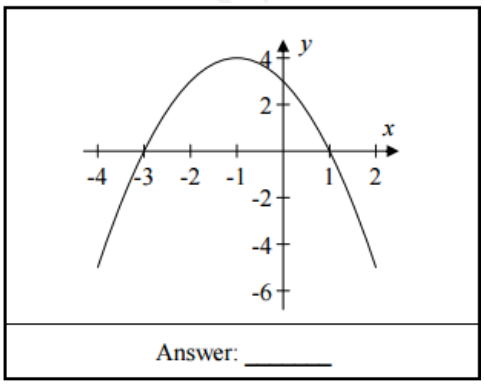
(b) Hence find the equation of $f(x)$.

10. **(2014 P1 Q10)**

(a) The graphs of the function $f(x) = x^2 + 2x - 3$ and $g(x) = x^2 - 2x + 3$ are shown below. Identify each graph by writing $f(x)$ or $g(x)$ in the space provided below the graph.

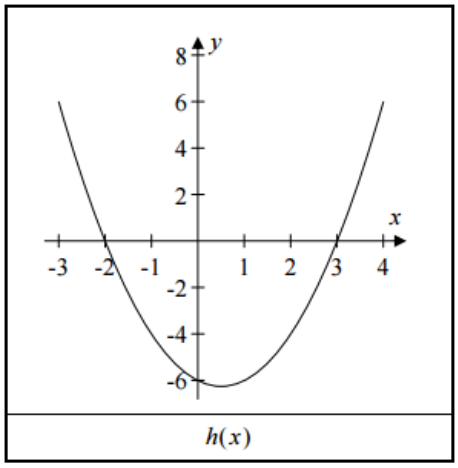


Answer: _____

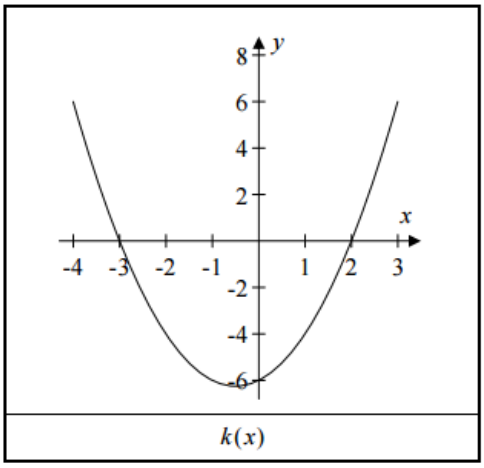


Answer: _____

(b) The graphs of $y = h(x)$ and $y = k(x)$ are shown below.



$h(x)$



$k(x)$

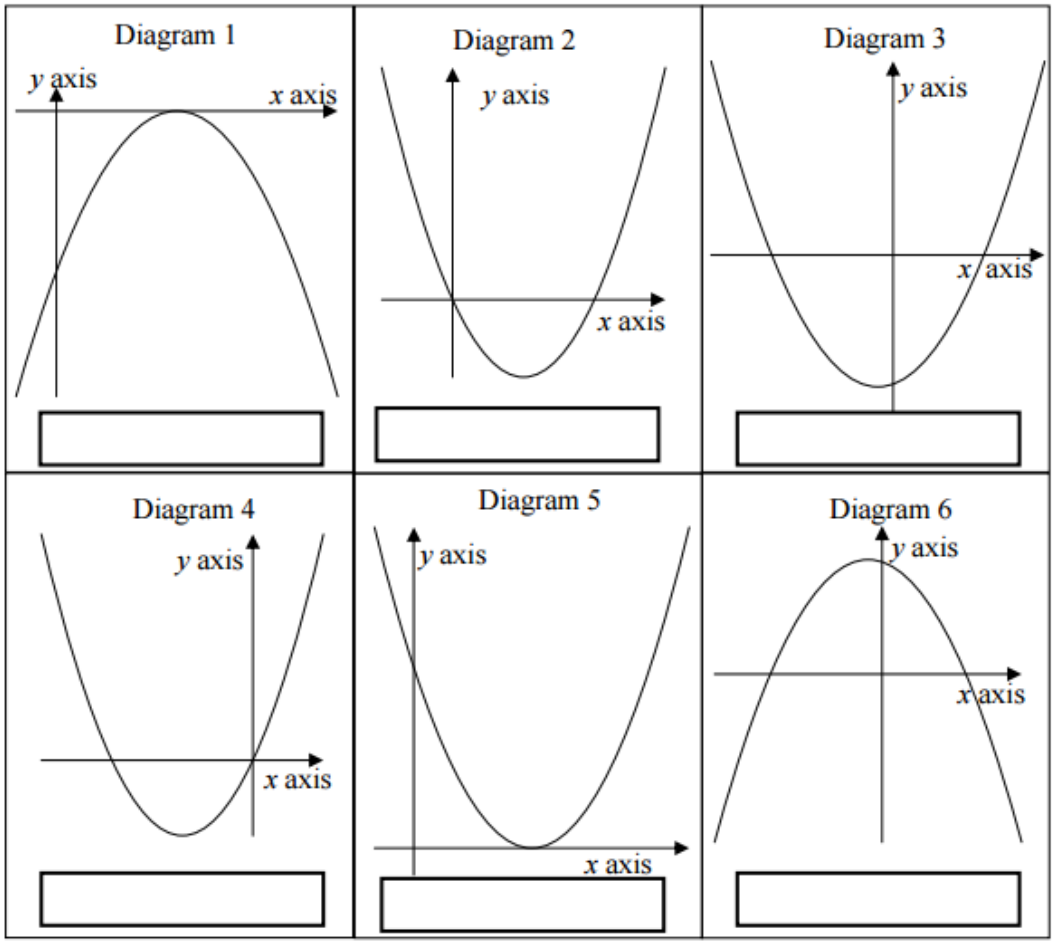
Write down the roots of each function.
Hence or otherwise, write down the equation for each function.

11. **(2013 P1 Q15)**

(a) Three functions: $f(x), g(x)$ and $h(x)$ are defined as follows:
$f(x) = 2x^2 + x - 6 \qquad g(x) = x^2 - 6x + 9 \qquad h(x) = x^2 - 2x$

i. Solve $f(x) = 0$
ii. Solve $g(x) = 0$
iii. Solve $h(x) = 0$

(b) The table below shows the sketches of six different functions. Three of the sketches belong to the three functions from part **(a)**.
Write $f(x), g(x)$ or $h(x)$ into the box underneath the correct sketch for each of the three functions.



12. **(2016 P1 Q 14)**
The function $h(x)$ below gives the particular height of the water at Howth Harbour on a particular day, form 12 noon to 5 p.m.

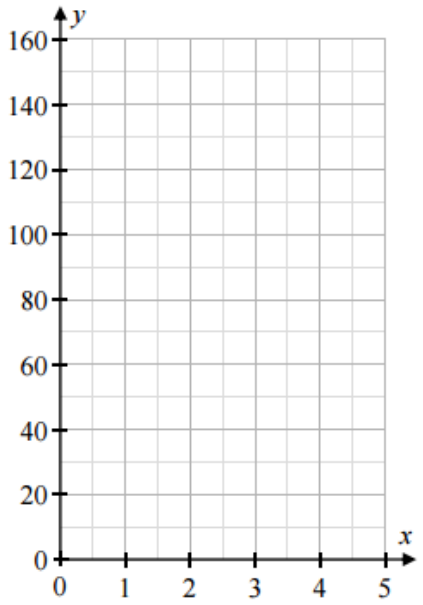
$$h(x) = 10x^2 - 50x + 130,$$

where $h(x)$ is the height of the water in centimetres, and x is the time in hours after 12 noon.

(a) Draw the graph of the function

$$h(x) = 10x^2 - 50x + 130$$

on the axes for $0 \leq x \leq 5, x \in R$.



(b) Use your graph in part **(a)** to answer the following questions.

i. Find the height of the water at 12 noon.

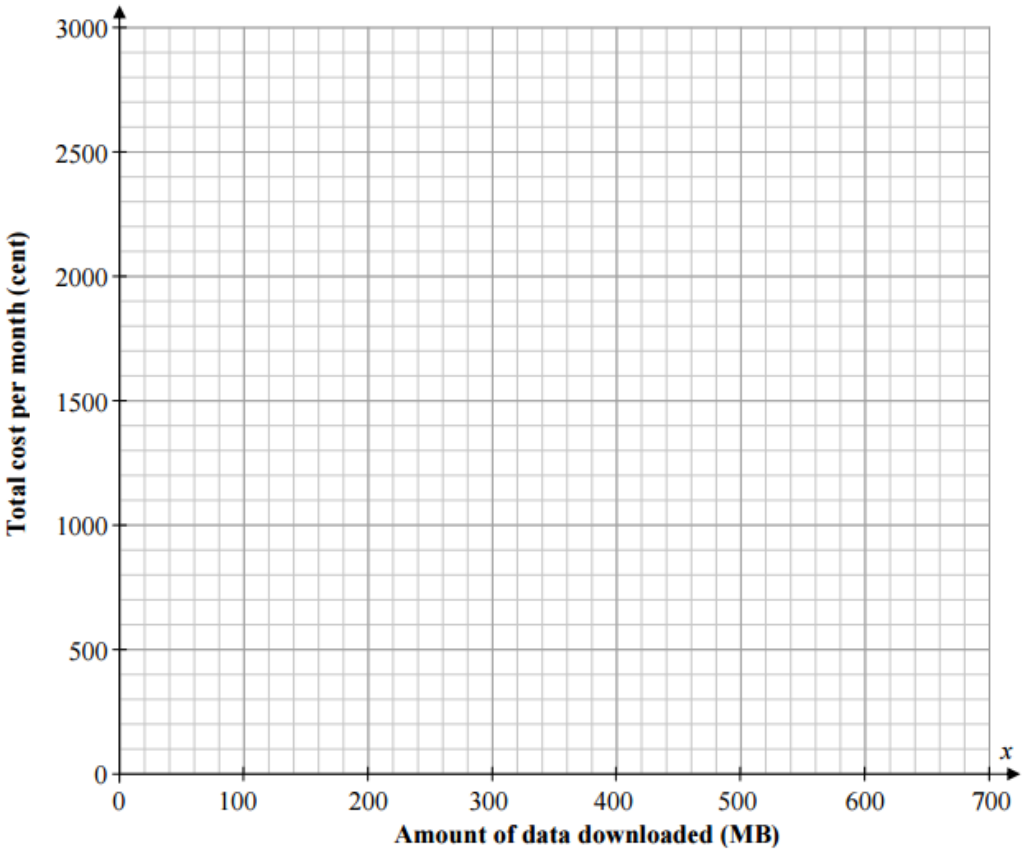
ii. Estimate the height of the water at its lowest point.

iii. After 12 noon, how long did it take before the water was at its lowest point?

13. **(2015 P1 Q6)** Two mobile phone companies, Cellulon and Mobil, offer price plans for mobile internet access.
A formula, in x, for the total cost per month for each company is shown in the table below.
x is the number of MB of data downloaded per month.

Phone company	Total cost per month (cent)
Cellulon	$c(x) = 4x$
Mobil	$m(x) = 1000 + 2x$

(a) **Draw** the graphs of $c(x)$ and $m(x)$ on the coordinate grid below to show the total cost per month for each phone company, for $0 \leq x \leq 700$. **Label** each graph clearly.



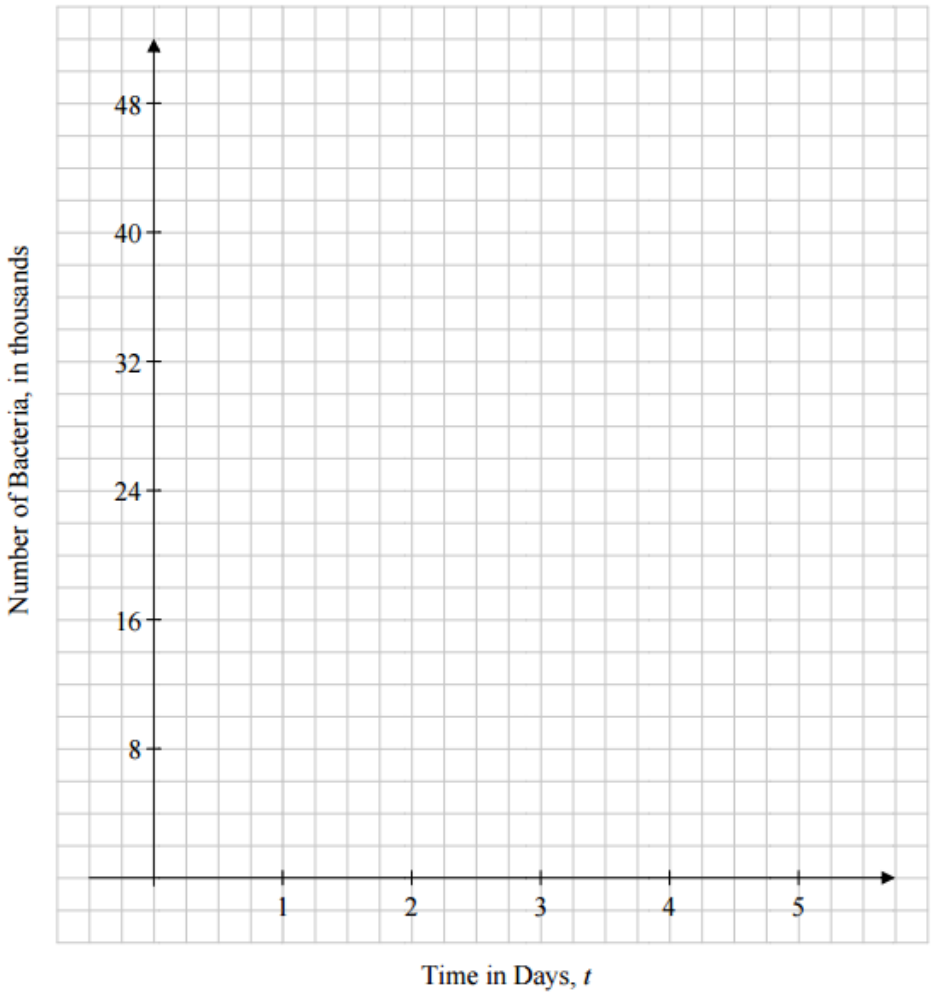
(b) Which company charges **no** fixed monthly fee?
Justify your answer, with reference to the relevant formula or graph.

(c) Write down the **point of intersection** of the two graphs.

(d) Fergus wants to buy a mobile phone from one of these two companies, and wants his mobile internet bill to be as low as possible.
Explain how your answer from part **(c)** would help Fergus choose between Cellulon and Mobil.

14. **(2014 P1 Q14)**
Paul and Marie have been studying the growth of a particular bacterium in school. They each come up with a function to predict the number of bacteria in a colony, in thousands, after t days. They both assume that there are 1000 bacteria in the colony at the beginning ($t = 0$).
Paul comes up with the function: $f : t \to 2^t$.
Marie comes up with the function: $g : t \to t^2 + 2t + 1$.

i. On the grid below, draw the graphs of $y = f(t)$ and $y = g(t)$ in the domain $0 \leq t \leq 5, t \in R$.



For parts **(ii)**, **(iii)**, and **(iv)**, you must show your working out on the diagram on the previous page.

ii. Use your graphs to find the difference in the number of bacteria predicted by Paul and the number of bacteria predicted by Marie after 2.5 days.

iii. Use your graphs to estimate the range of values of t for which **both** Paul and Marie predict that there will be at least 20,000 bacteria in the colony. (Give answer in format $t \geq$: ans)

iv. By extending your graphs, estimate the value of t (other than $t = 0$) for which the number of bacteria predicted by Paul and the number of bacteria by Marie will be the same.

v. The actual number of bacteria after two weeks (14 days) is roughly 1.6×10^7. Based on this, which formula would you say gives the better prediction for the number of bacteria? Explain your answer.

5.2 Functions Continued

1. A function $f(x)$ is defined as $f(x) = x + 2$. Find:
   (a) $f(1)$
   (b) $f(3)$
   (c) $f(-1)$
   (d) $f(-2)$

2. If $f(x) = 3x - 2$, find:
   (a) $f(3)$
   (b) $f(4) + f(2)$
   (c) $4 + f(2)$
   (d) $f(\frac{1}{2})$
   (e) $f(3) - f(1)$
   (f) $3 - f(1)$

3. If $f(x) = 2x + 4$, find:
   (a) $f(3) + f(5)$
   (b) $f(3) + 5$
   (c) $3f(5)$
   (d) $5f(3)$
   Find in terms of k
   (e) $f(k)$
   (f) $f(3k)$
   (g) $f(k + 3)$
   (h) $f(k) + 3$

4. **(2015 P1 Q4)**
   Let $f(x) = 3x + 5$, for $x \in R$.
   (a) Find the value of $f(7)$.
   (b) Write $f(k)$ in terms of k.
   (c) Using your answer to part **(b)**, or otherwise, find the value of k for which $f(k) = k$.

5. If $f(x) = 3 - 4x$, Solve for x:
   (a) $f(x) = -5$
   (b) $f(x) = x$
   (c) $f(x) = f(-1)$
   (d) $f(x) = 15$
   (e) $f(x) + f(2x) = 0$

6. **(2012 P1 Q14)**
   Let g be the function $g : x \to 2^{x-3}$.
   (a) Find the value of $g(3)$.
   (b) Let h be the function $h : x \to x^2 - 3x$
      i. Express $h(t)$ and $h(2t + 1)$ in terms of t.
      ii. Hence find the values of t for which $h(t) = h(2t + 1)$.

5.3 Functions with unknown coefficients

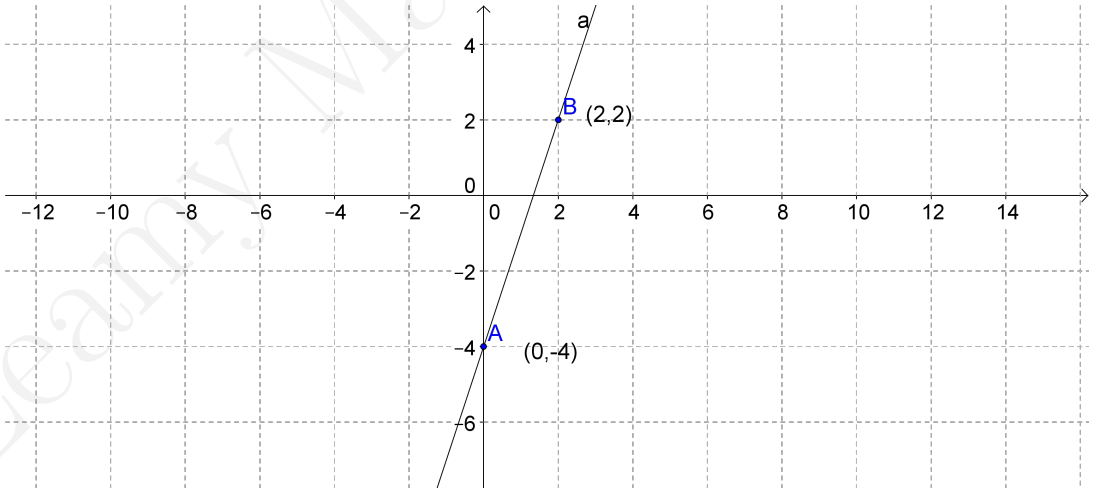
1. If $F(x) = bx + 4$, $F(3) = 13$. Find b

2. If $F(x) = ax - 3$, $F(5) = 7$. Find a

3. $(4, 2)$ is a point on the line $F(x) = ax - 8$. Find the value of a.

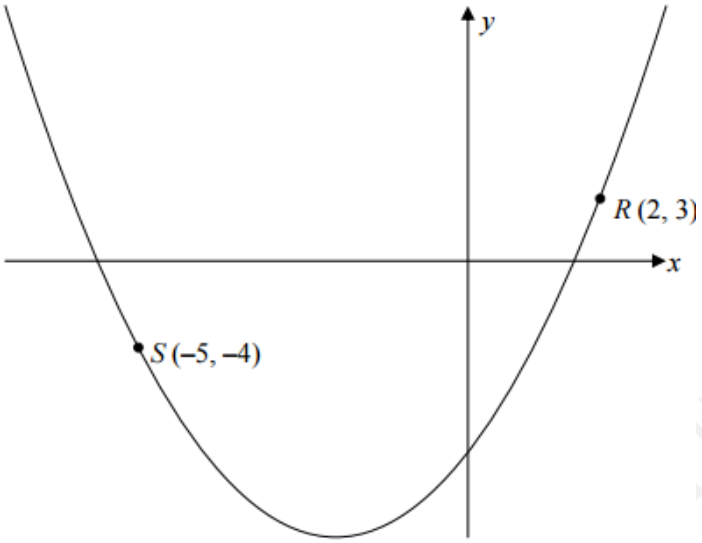
4. $F(x) = rx^2 + 3x + 1$ is a function. If $(-2, 7)$ is a point of the function find the value for r

5. The graph of the linear function $F(x) = 3ax + 2b$ is shown. Find values for a and b.



6. A function is defined by $3ax^2 - 2bx + 4$. If $F(4) = -124$ and $F(-1) = 6$, find the value for a and b.

7. **(2015 Sample P1 Q10)** Part of the graph of the function $y = x^2 + ax + b$, where $a, b \in Z$, is shown below. The points $R(2, 3)$ and $S(-5, -4)$ are on the curve.



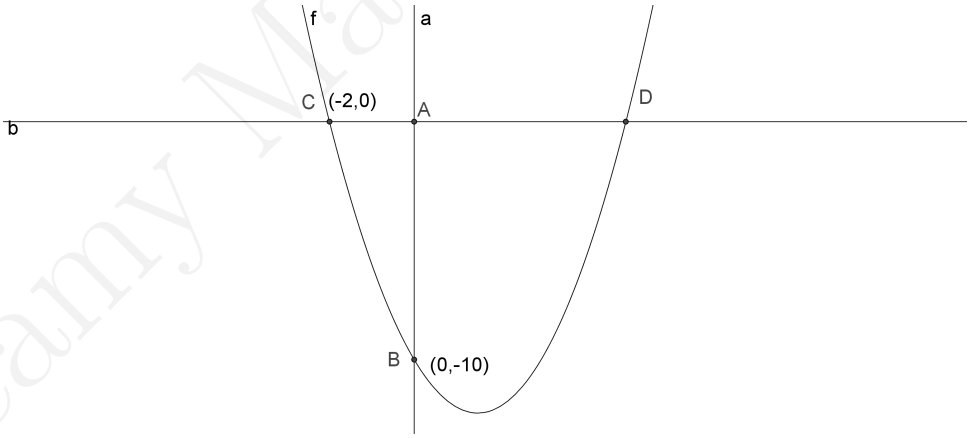
(a) Use the given points to form two equations in a and b.

(b) Solve your equations to find the value of a and the value of b.

(c) Write down the co-ordinates of the point where the curve crosses the y-axis.

(d) By solve an equation, find the points where the curve crosses the x-axis. Give each answer correct to one decimal place.

8. The function $f(x) = x^2 + px + q$ is shown on the graph.

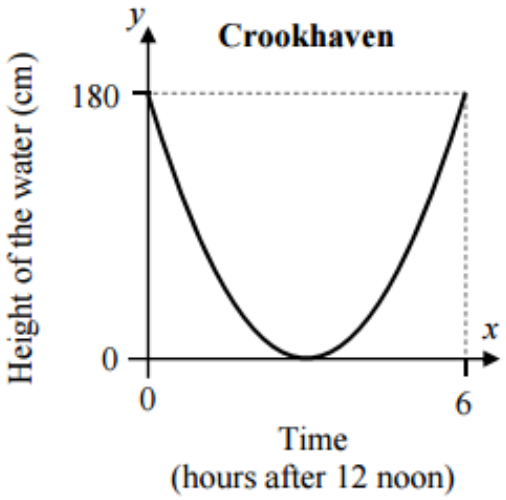


i. Use the point $(0, -10)$ to find q.

ii. Use another point to create an equation to find p

iii. Using these values for p and q, solve the equation $x^2 + px + q = 0$ to find the point D

The graph on the right shows the approximate height of the water in centimetres at Crookhaven, from 12 noon to 6 p.m. The graph is symmetrical.
On this day, the height of the water at 12 noon was 180 cm, and the hioght of the water at the lowest point on the graph was 0 cm.



(c) Taking x as the time in hours after 12 noon, this graph is given by the function

$$g(x) = ax^2 + bx + c,$$

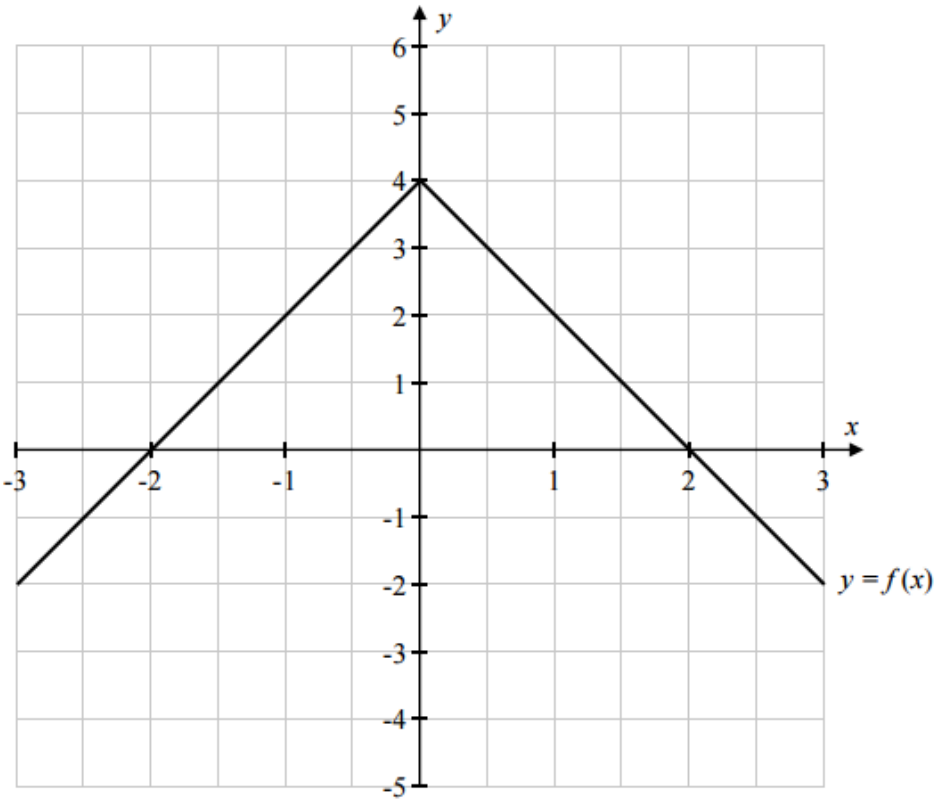
where $a, b, c \in Z$, and $x \in R$.

i. Find the value of c

ii. Hence, or otherwise, find the value of a and b.

9. **(2016 P1 Q10)**

(a) The graph of the function $y = f(x)$ is shown on the co-ordinate diagram below, for $-3 \leq x \leq 3$, $x \in R$. The graph is made up of two line segments.

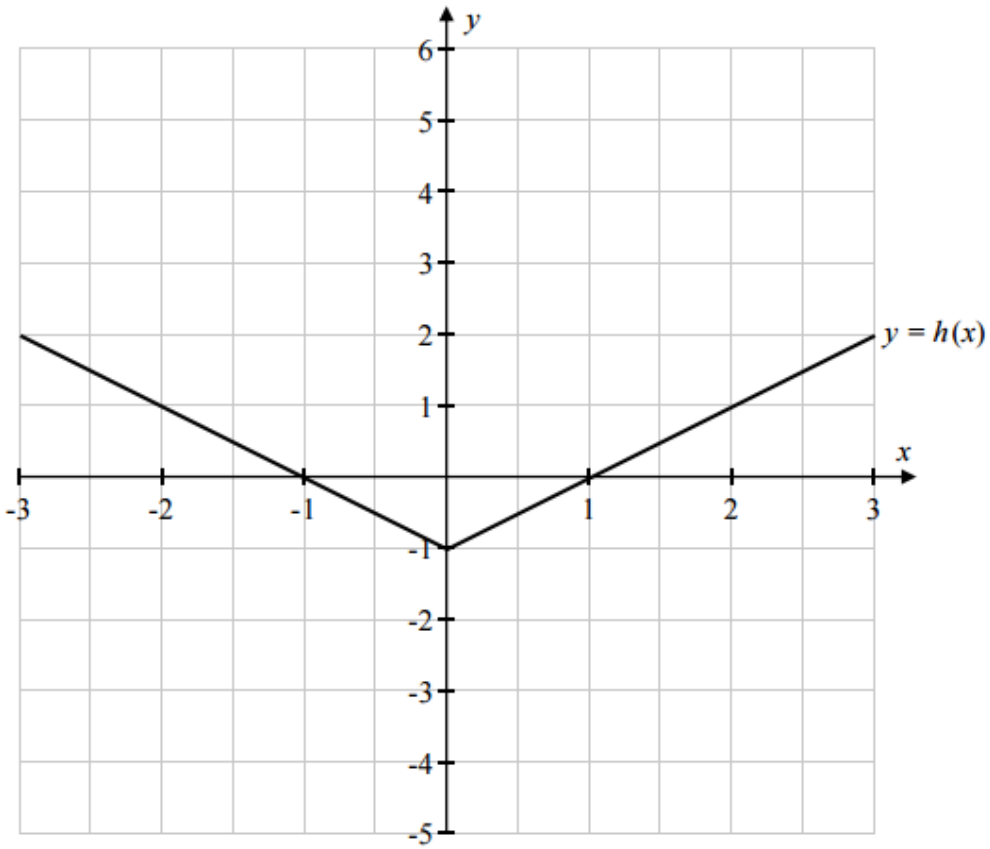


i. Fill in the table below (on top of the next page) to show the value of $\boldsymbol{f(x)}$ and the value of $\boldsymbol{f(x) - 2}$ for each of the given values of x.

x	-3	-2	-1	0	1	2	3
$f(x)$							
$f(x)-2$							

ii. Hence or otherwise, **draw** the graph of $\boldsymbol{y = f(x) - 2}$ on the coordinate diagram above (previous page), for $-3 \leq x \leq 3$, $x \in R$.

(b) The graph of a different function, $y = h(x)$, is shown on the co-ordinate diagram below, for $-3 \leq x \leq 3$, $x \in R$. The graph is made up of two line segments.

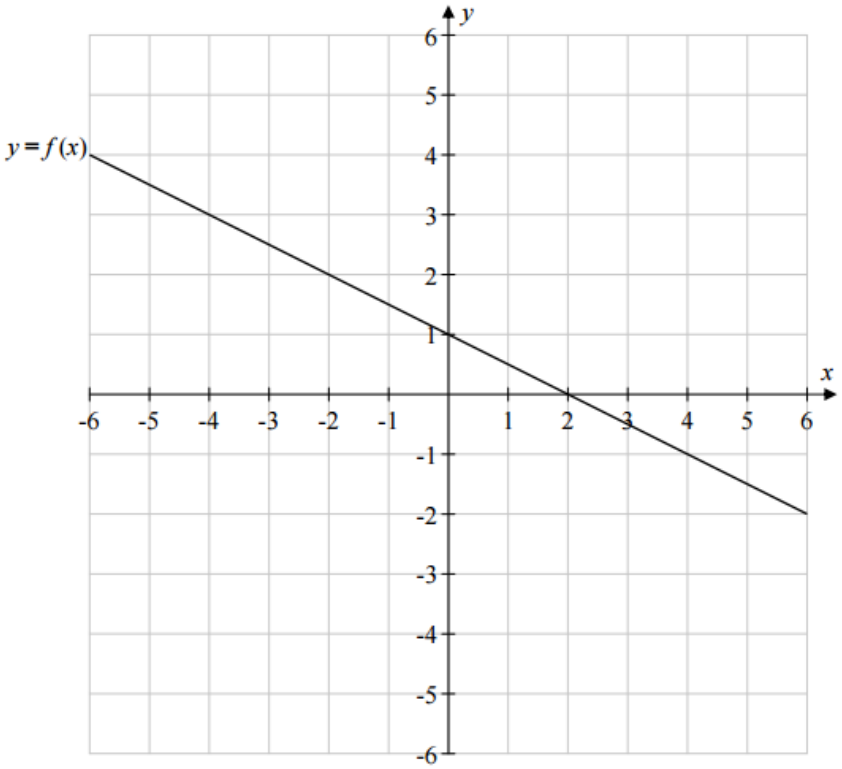


i. Fill in the table to show the value of $\boldsymbol{h(x)}$ for each of the given values of x.

x	-3	-2	-1	0	1	2	3
$h(x)$							

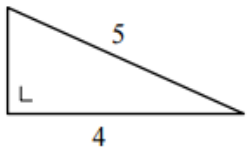
ii. Hence or otherwise, **draw** the graph of $\boldsymbol{[h(x)]^2}$ on the coordinate diagram above, for $-3 \leq x \leq 3$, $x \in R$.

10. **(2015 P1 Q13)** The graph of the linear function $y = f(x)$ is drawn on the co-ordinate grid below.
Using the same axes, draw the graph of each of the following functions, where $-6 \leq x \leq 6$, $x \in R$.
Label each graph clearly.
    (a) $y = f(x) + 2$
    (b) $y = f(x)$

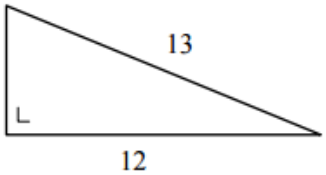


6 Further Context and Applications

1. **(2015 P1 Q11)**
Two right angled triangles are shown below.
    (a) Find the height of each triangle.



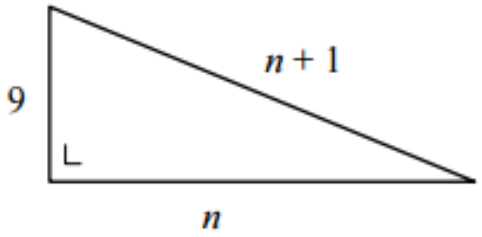
Height = ☐



Height = ☐

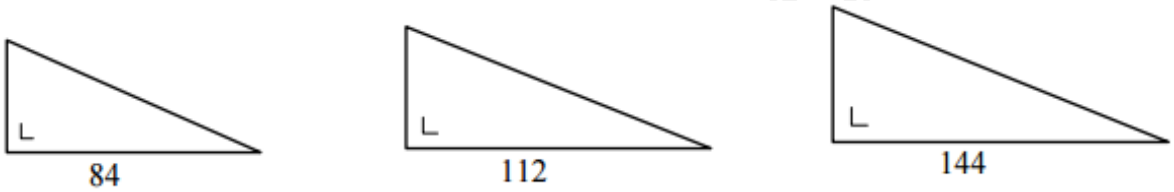
The triangles above are the first two triangles (with sides of integer lengths) where the hypotenuse is 1 unit longer than the base.

(b) Another such triangle is shown on the right. It has a height of 9 units.
Use the theorem of Pythagoras to find the value of n, the length of the base of this triangle.



These triangles can be put in a sequence of increasing size.
The lengths of the bases of the triangles in this sequence follow a **quadratic** pattern.
Three consecutive triangles in this sequence are shown below.

(c) Use this information to find the length of the base of the next triangle in the sequence.



The lengths of the hypotenuse, h, of triangle x in this sequence is given by the function below, where b and c are integers.

$$h(x) = 2x^2 + bx + c$$

Also, $h(1) = 5$ and $h(2) = 13$.

(d) i. Use this information to write two equations in b and c.

ii. Solve these equations to find the value of b and c.