1. (3,1 = 4 Marks)

(a) Explain, with reference to the discriminant in the quadratic formula, why the function $f(x) = 2x^2 - 12x + 18$ has only one root.

$\Delta = b^2 - 4ac$ ✓

$= (-12)^2 - 4.(2).(18)$

$= 144 - 144$ ✓

$= 0$ ✓

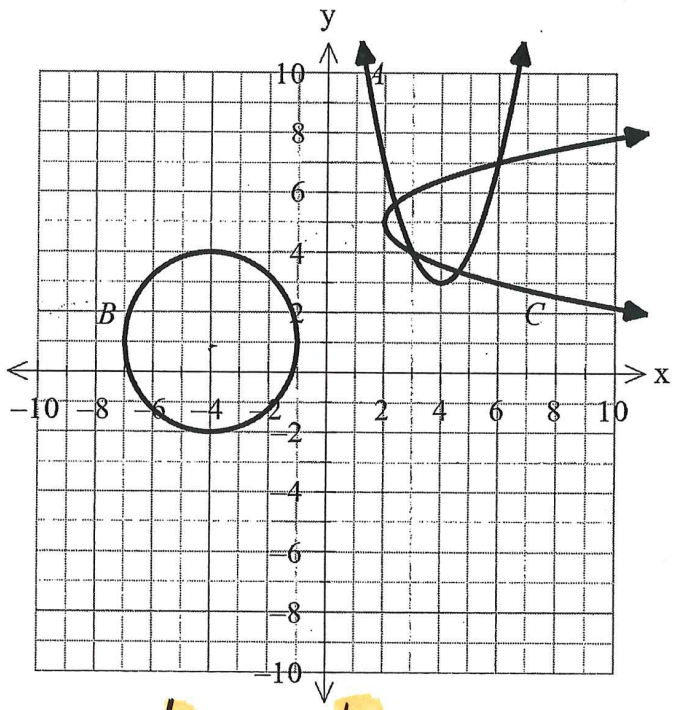
Since the discriminant is zero, there is only 1 root.

(b) From your answer in part (a), what can you say about the turning point of this function?

We can conclude that the turning point lies on the x axis. ✓

2. (7 Marks)

Determine the equation of each of the graphs drawn below.



A: $y = (x-4)^2 + 3$ ✓ ✓

B: $(x+4)^2 + (y-1)^2 = 9$ ✓ ✓ ✓

C: $(y-5)^2 = x - 2$ ✓ ✓

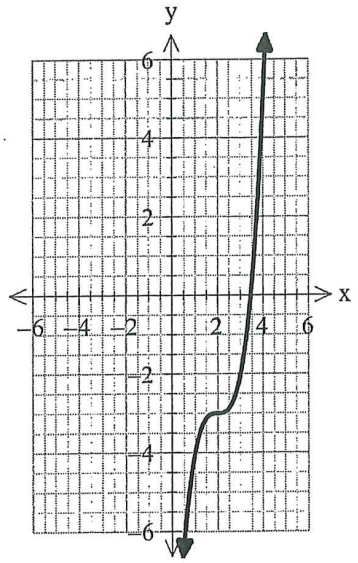
3. (6 Marks)

Match each of the following graphs with the functions listed in the table. Record the letter for each graph next to the appropriate function equation.

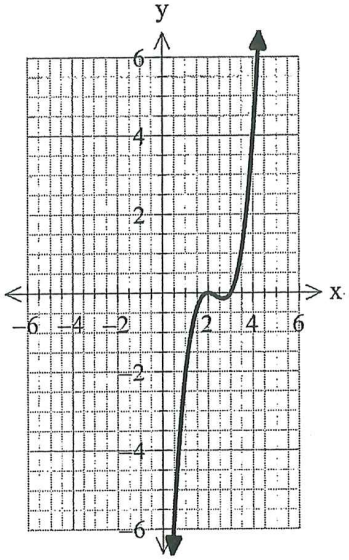
1. $y = -x(x+2)^2$	D	2. $y = -x(x+2)(x-3)$	C
3. $y = (x-2)^2\,(x-3)$	B	4. $y = -(x+3)(x+1)\,(x-2)$	F
5. $y = -(x-3)^3 - 2$		6. $y = (x-2)^3 - 3$	A
7. $y = x(x-2)^2$		8. $y = (x-3)^2\,(x-2)$	
9. $y = x(x-2)(x+3)$		10. $y = -(x+3)^3 - 2$	E

1 MARK EACH.

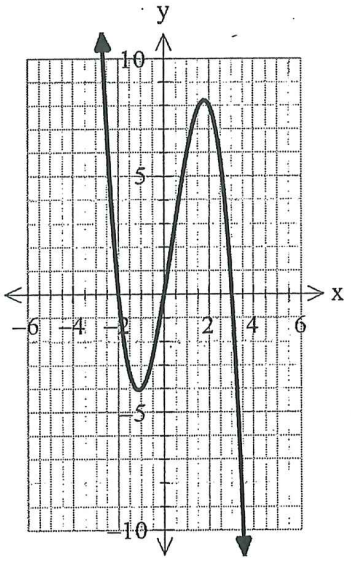
A.



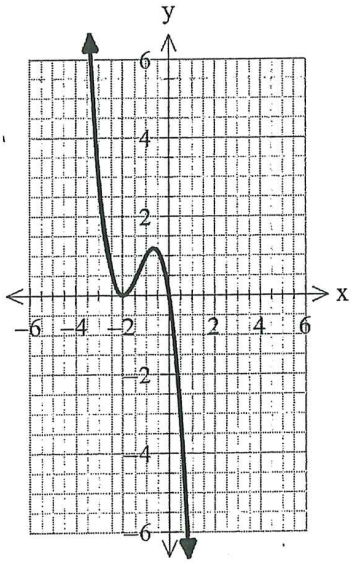
B.



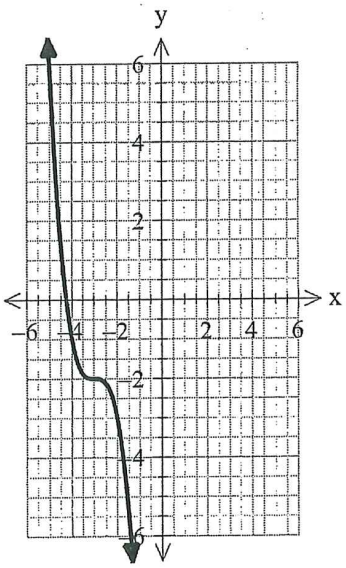
C.



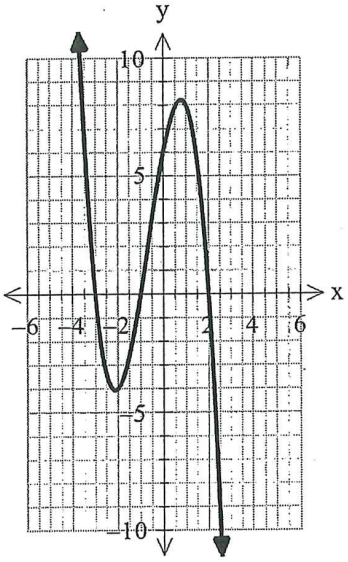
D.



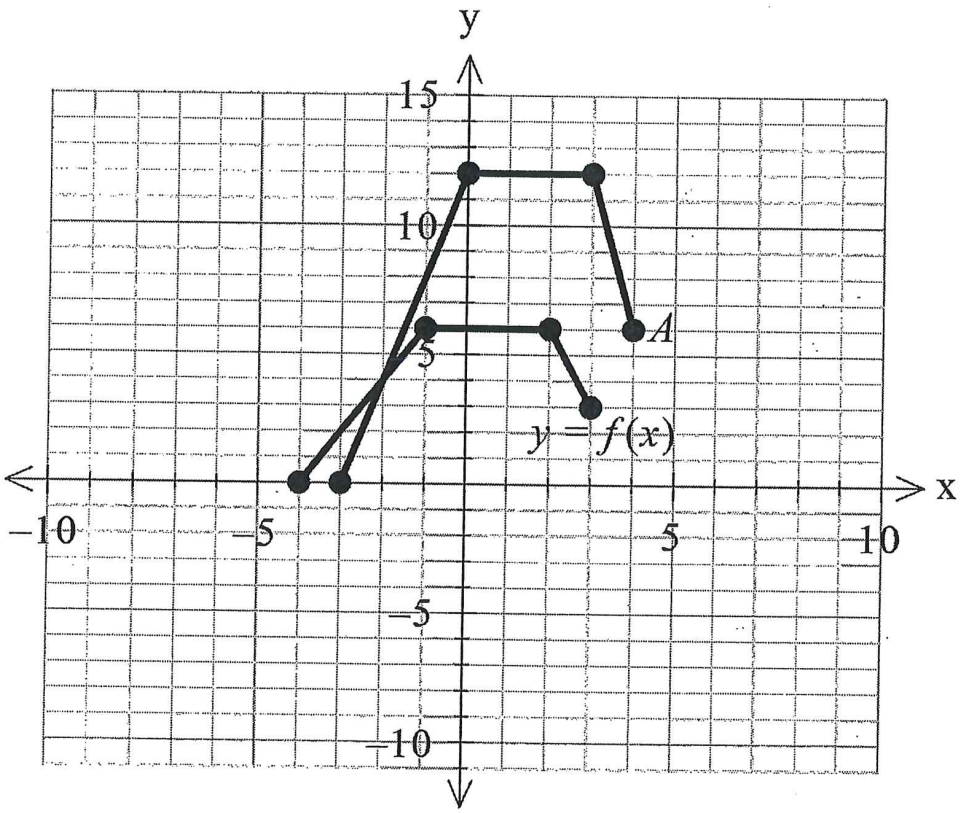
E.



F.



4. (1, 1, 3 = 5 Marks)



The function $y = f(x)$ is drawn above.

(a) State the domain $\{x : x \in \mathbb{R}, -4 \leq x \leq 3\}$ 1

(b) State the range $\{y : y \in \mathbb{R}, \ 0 \leq y \leq 6\}$ 1

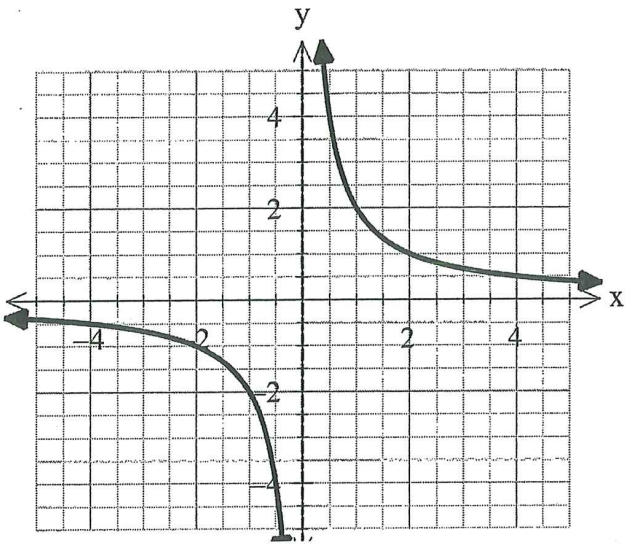
(c) Describe the transformations involved for $y = f(x)$ to move to the graph of A

Translate horizontally 1 unit right 1
Dilate parallel to the y axis (vertically) 1
by a scale factor of 2 1

5. (1, 1, 2 = 4 Marks)

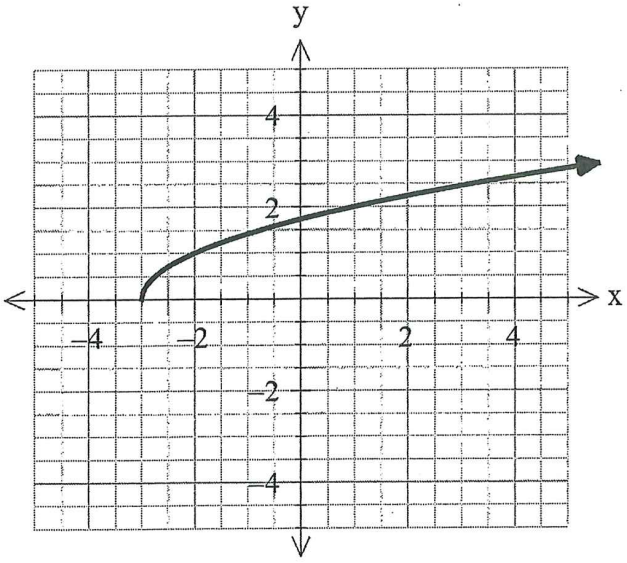
Determine the equation of each of the following functions:

(a)



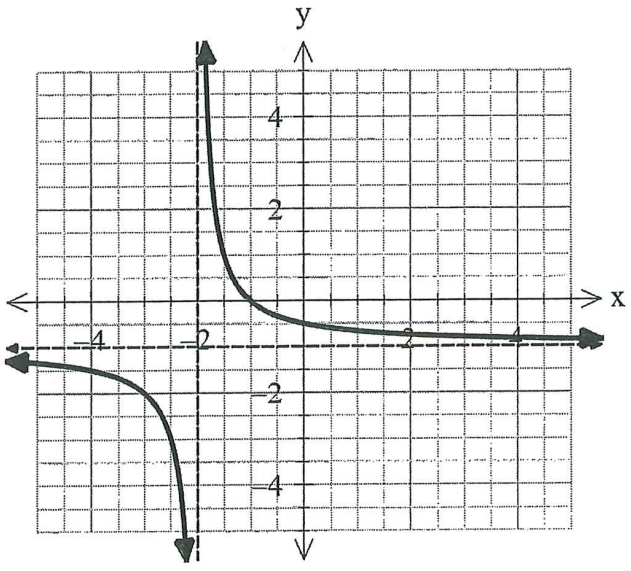
$y = \frac{2}{x}$ 1

(b)



$y = \sqrt{x+3}$ 1

(c)



$y = \frac{1}{x+2} - 1$ 1 1

6. (1, 2, 2, = 5 Marks)

(a) Complete the next row of Pascal's Triangle.

1	Row 0
1 1	Row 1
1 2 1	Row 2
1 3 3 1	Row 3
1 4 6 4 1	Row 4
1 5 10 10 5 1	Row 5
1 6 15 20 15 6 1	Row 6
1 7 21 35 35 21 7 1	Row 7
1 8 28 56 70 56 28 8 1	Row 8

1

Use Pascal's Triangle to answer the following questions.

(b) Expand and simplify $(x-2)^6$.

$x^6 + 6x^5(-2)^1 + 15x^4(-2)^2 + 20x^3(-2)^3 + 15x^2(-2)^4 + 6x(-2)^5 + (-2)^6$

$= x^6 - 12x^5 + 60x^4 - 160x^3 + 240x^2 - 192x + 64.$

1 correct coefficients

1 ± correct solution.

(c) Factorise $a^5 - 5a^4b + 10a^3b^2 - 10a^2b^3 + 5ab^4 - b^5$.

$(a-b)^5$ 1

1

End of Non-Calculator Section

WILLETTON SENIOR HIGH SCHOOL

METHODS YEAR 11

TERM 2, 2021

TEST 2

CALCULATOR ASSUMED SECTION

Name: SOLUTIONS

Circle/Highlight Teacher Name:

Ms Leow	Mrs Kalotay	Mr Riemer	Mrs Scoles
Ms Tsen	Ms Thompson	Mr Whiteley	

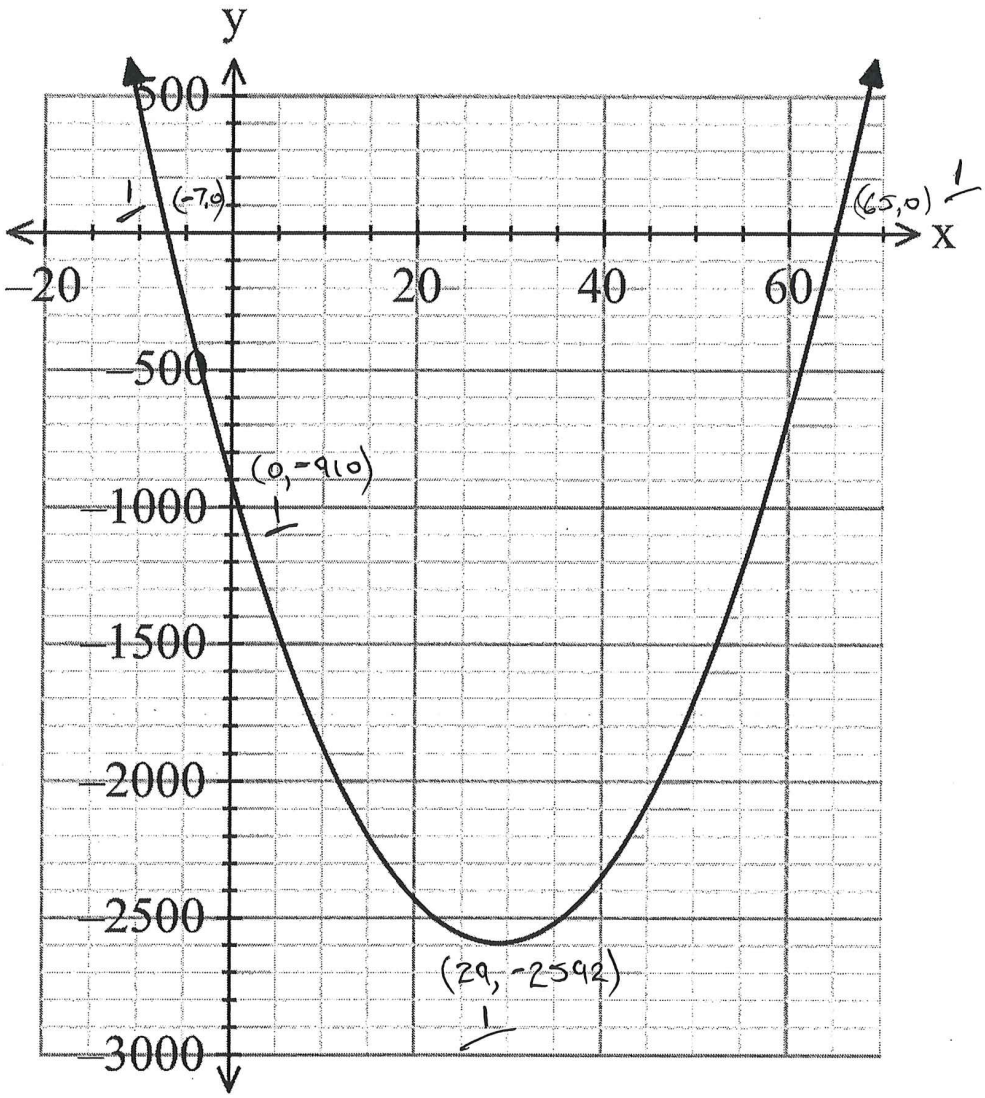
Marks: 37 Marks

Time: 30 Minutes

7. (4, 1, 2 = 7 Marks)

A surfboard shaper is trying to design the ultimate 'fin' shape to maximise speed on the wave. She has found that to minimise wave water interference, her latest fin models a quadratic function, dimensions are in mm.

(a) On the axes below sketch $y = 2x^2 - 116x - 910$, showing all intercepts and turning points.



(b) State the equation of the axis of symmetry for the fin.

$x = 29$ 1

(c) Hence or otherwise rewrite the equation of the function into the form $y = a(x + d)(x + e)$

$y = 2(x + 7)(x - 65)$

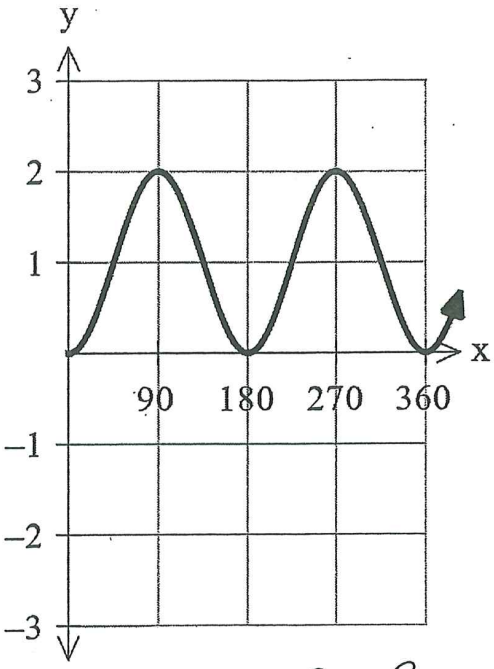
1 1

1 for Dilation factor.
1 for both correct x intercepts

8. (3, 3 = 6 Marks)

Determine the equation of each of the following trigonometric functions.

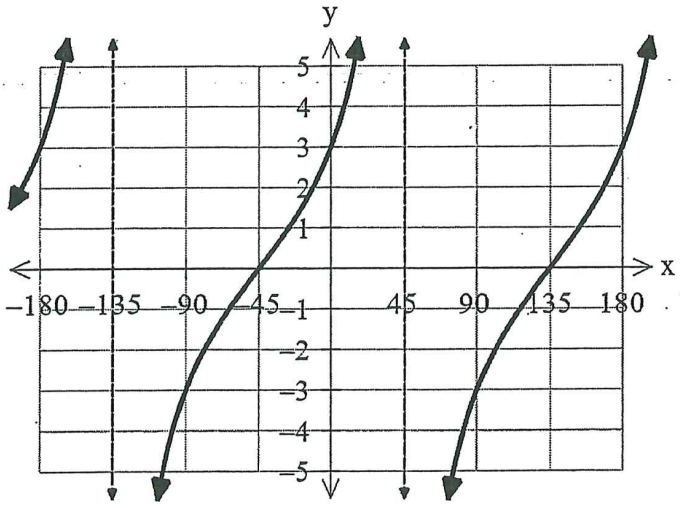
(a)



$y = -\cos 2x + 1$ or $y = \sin 2(x - 45^\circ) + 1$.

1 1 1

(b)



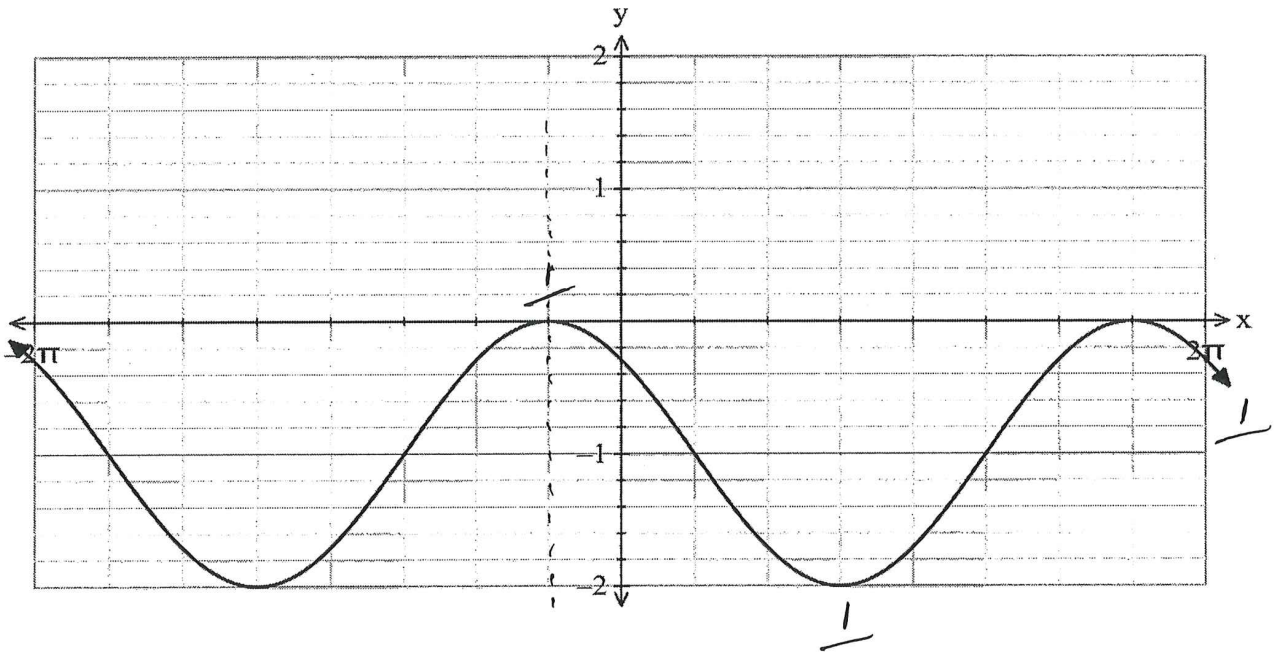
$y = 3\tan(x + 45^\circ)$

1 1 1

9. (3 Marks)

Sketch the following function on the axis below

$$y = \cos\left(x + \frac{\pi}{4}\right) - 1$$



1 – Amplitude
1 – Correct Horizontal Translation
1 – Overall Correctness / Smoothness

10. (4, 3 = 7 Marks)

The function $f(x) = 2x^3 + px^2 + qx + 12$ has 3 factors.
$x - 3$ is one of the factors of $f(x)$.
We also know that $f(-2) = 50$.

(a) Determine the values of p *and* q using the above information and showing all working.

$x-3$ is a factor $\Rightarrow f(3)=0$

i.e. $2(3)^3 + p(3)^2 + q(3) + 12 = 0$

$54 + 9p + 3q + 12 = 0$

$9p + 3q = -66$ 1

We also know $f(-2) = 50$

i.e. $2(-2)^3 + p(-2)^2 + q(-2) + 12 = 50$

$-16 + 4p - 2q + 12 = 50$

$4p - 2q = 54$ 1

Solving simultaneously $p = 1$ 1

$q = -25$ 1

(b) Hence or otherwise, determine the three x intercepts of the function $f(x)$.

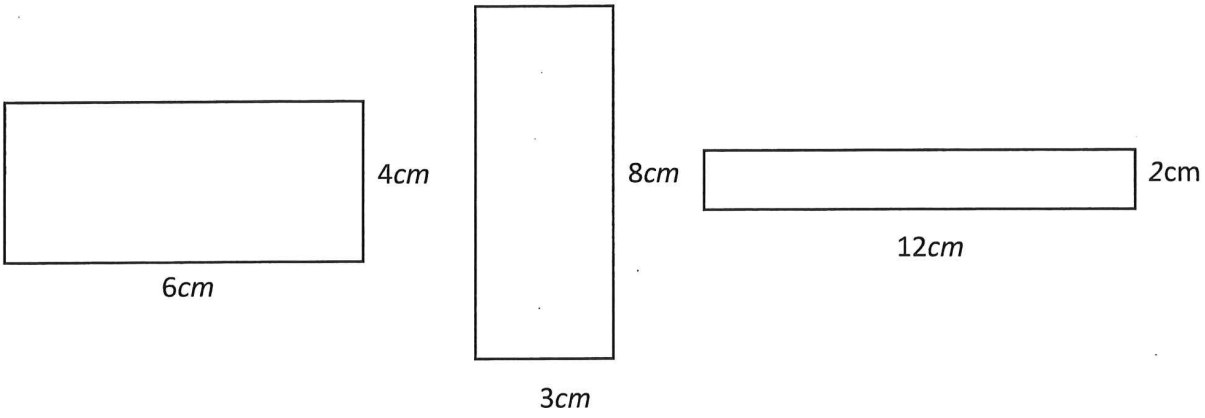
$(-4, 0)$, $(0.5, 0)$, $(3, 0)$

1 1 1

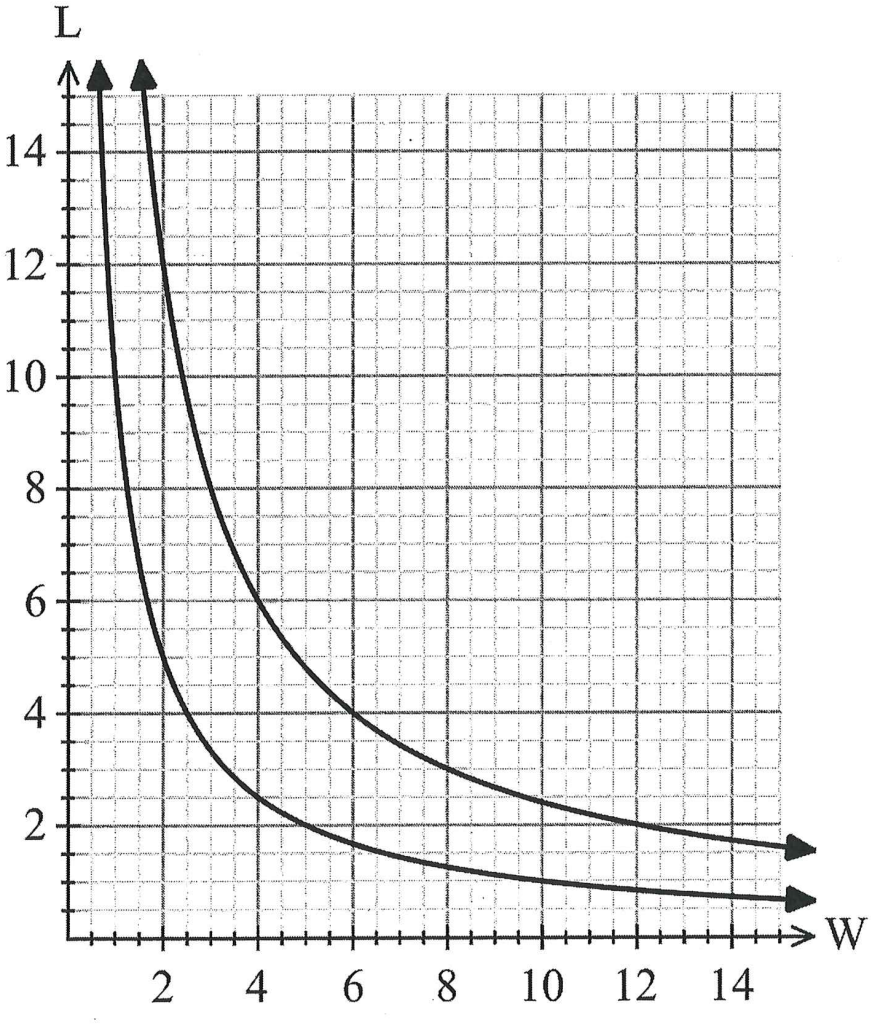
11. (1, 2, 1, 2, 2 = 8 Marks)

A teacher asks her Year 7 class to draw a rectangle with an area of 24 cm^2. She then asks a few students to draw their answer on the board and each answer is different.

Here are three possible solutions that the students gave.



The teacher's next class is Year 11 Maths Methods. She asks these students to graph each pair of dimensions of the rectangles drawn on the board.



2 MARKS
1- Correct points
1- Smoothness of shape

(a) What type of relationship exists between the length and width of a rectangle with a constant area?

An Inverse Relationship. 1

(b) Determine a rule which defines the relationship for the graph and state the value of k, the constant of proportionality.

$k = 24$ 1 $L = \frac{24}{W}$ 1

(c) Use your rule to find the length of the rectangle if the width is 1.5 cm.

$L = 16$ cm. 1

(d) If the area of the rectangle was 10 cm^2, draw the curve defining the relationship between the length and width of this rectangle on the previous graph.

See Graph

(e) Using your graphs or otherwise, describe the transformation that transforms the original graph to the graph in part (d).

Vertical Dilation, scale factor = $\frac{10}{24}$ 1

OR

Horizontal Dilation scale factor $\frac{10}{24}$ 1