

[5 Marks]

$$\text{Eq. } (-1, 18) \checkmark$$

$x = -1$
Line of symmetry:

$$y\text{-intercept: } (0, 16) \checkmark$$

$$x\text{-intercepts: } (2, 0) \text{ and } (-4, 0)$$

$$y = -2x^2 - 4x + 16$$

1. Determine the equation of the line of symmetry, the turning point and all intercepts of the parabola given by the equation $y = (2 - x)(2x + 8)$.

End of Test

You will be supplied with a formula sheet.

Instructions: You ARE NOT allowed any notes or calculators.

Time Allowed: 30 minutes

Marks:

30

Name: _____ Teacher: _____

SOLUTIONS

Year 11 Methods - Test Number 1b
MATHEMATICS DEPARTMENT
Functions and Graphs
Resource Free
ALL SAINTS' COLLEGE



$x^2 + y^2 = 36$ at two points.
Use the discriminant to show that the line $2x - y + 3 = 0$ intersects the circle

$$b^2 - 4ac = 2 \text{ solutions } \Delta > 0.$$

= +

$$b^2 - 4ac = 144 + 540$$

$$9x^2 + 12x - 27 = 0$$

$$= x^2 + 4x^2 + 12x + 9 - 36 = 0$$

$$x^2 + (2x+3)^2 = 36$$

3. [4 marks]

2. Given that $f(x) = x^2 - ax + 5$, find the value of a if the turning point is $(3, -4)$.

$$\begin{aligned} -4 &= 3^2 - 3a + 5 \quad \checkmark \\ \Rightarrow -4 &= 9 - 3a + 5 \\ \Rightarrow 3a &= 18 \quad \text{Thus } a = 6 \quad \checkmark \end{aligned}$$

[2 Marks]

3. The lines $y = 3 - x$ and $y = 3x - 5$ intersect at the point B. Find the equation of the line that is perpendicular to $4y + x = 12$ and that passes through point B.

$$\begin{aligned} 3-x &= 3x-5 \\ 8 &= 4x \\ \therefore x &= 2, y = 1 \quad \checkmark \\ \text{From } 4y+x &= 12 \Rightarrow y = -\frac{x}{4} + 3 \quad \therefore m = -\frac{1}{4} \quad \checkmark \\ &\Rightarrow \perp m = 4 \quad \checkmark \\ y &= 4x+c \\ 1 &= 8+c \\ \Rightarrow c &= -7 \quad \checkmark \\ \therefore y &= 4x-7 \quad \checkmark \end{aligned}$$

[5 Marks]

4. Find the equation of the parabola in the form $y = ax^2 + bx + c$, that passes through the points $(1, -12)$, $(0, -12)$ and $(4, 12)$

$$\begin{aligned} y &= ax^2 + bx + c \\ \text{Note: } c &= -12 \text{ from the point } (0, -12) \quad \checkmark \\ (1, -12) : -12 &= a+b-12 \quad \} \\ (4, 12) : 12 &= 16a+4b-12 \quad \} \\ \Rightarrow 0 &= 16a+16b \quad \checkmark \quad \checkmark \\ 0 &= 16a+4b-24 \quad \checkmark \quad \checkmark \\ \Rightarrow 12b &= -24 \quad \therefore b = -2, a = 2 \quad \text{Equation } y = 2x^2 - 2x - 12 \quad \checkmark \quad \checkmark \end{aligned}$$

[6 Marks]

2. [4, 4 = 8 marks]

Solve the following equations using the method shown, simplifying your answers where appropriate.

- a) $x^2 - 7x = -3$ (by completing the square)

$$\begin{aligned} x^2 - 7x + 3 &= 0 \\ \Rightarrow \left(x - \frac{7}{2}\right)^2 - \frac{49}{4} + \frac{12}{4} &= 0 \quad \checkmark \\ \Rightarrow \left(x - \frac{7}{2}\right)^2 - \frac{37}{4} &= 0 \\ \Rightarrow \left(x - \frac{7}{2} - \frac{\sqrt{37}}{2}\right) \left(x - \frac{7}{2} + \frac{\sqrt{37}}{2}\right) &= 0 \quad \checkmark \\ \therefore x &= \frac{7 \pm \sqrt{37}}{2} \quad \checkmark \quad (-1 \text{ for } 0.459 \text{ and } 6.541) \end{aligned}$$

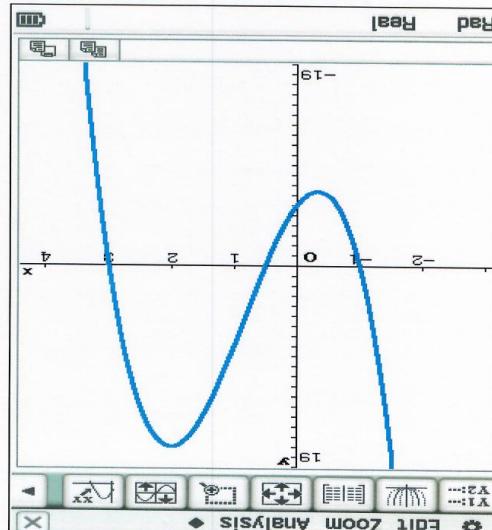
- b) $-3x^2 - 2 = 5x$ (using the quadratic formula)

$$\begin{aligned} 3x^2 + 5x + 2 &= 0 \\ \Rightarrow a &= 3, b = 5, c = 2 \quad \checkmark \\ -b \pm \sqrt{b^2 - 4ac} &\Rightarrow -5 \pm \sqrt{25 - 4(3)(2)} \quad \checkmark \\ 2a & \\ \Rightarrow \frac{-5 \pm \sqrt{1}}{6} & \\ \Rightarrow \frac{-5+1}{6} \text{ or } \frac{-5-1}{6} & \\ \Rightarrow -\frac{2}{3} \text{ or } -1 & \\ \checkmark & \quad \checkmark \end{aligned}$$

The function $y = f(x)$ is shown below:

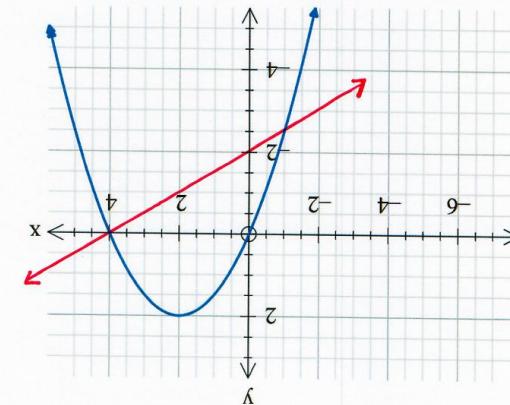
[2, 2, 2, 2 = 8 marks]

Determine the equation of the cubic function shown below:



$$\text{f}(x) = -\frac{x}{2}(x-4)$$

(a) State the equation of $f(x)$



Another function is given by $g(x) = 0.5x - 2$

c) Sketch $y = g(x)$ on the axes above.

2

What values of x does $f(x) = g(x)$?
 4, -1 but except:
 (4, 0) and (-1, -5/2)

d) For what values of x does $f(x) = g(x)$?

11 (see graph)

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[4 Marks]

$$\text{Therefore } y = -4(x+1)(x-\frac{1}{2})(x-3)$$

• 3 = + -

$$-\frac{6}{5} = \frac{2}{5}$$

Note 9 - Incomplete

$$\text{From the above } C = \frac{3}{2}a$$

$$h = \left(\frac{1-x}{1+x}\right)^n$$

{'f': 1 - :good}

(b) State the domain and range of $f(x)$

1

$$\wedge z \geq h = y_1$$

1 / 1

1

(4, 0) and (-1, -5/2)

d) For what values of x does $f(x) = g(x)$?

6. Choose from the list of functions and relations below:

A $x^2 + y^2 = 100$	B $y = x(x+2)^2$	C $y = \sqrt{(3x-1)} + 1$	D $y = \frac{3}{x+4}$
E $xy = 1$	F $y^2 = 13x$	G $\frac{2}{x-1} = 3-y$	H $y = x(x-9)$

and write down only the letter(s) of all those:

- a) which are NOT functions,

A, F
✓✓

-1 MARK FOR
INCORRECT GRAPH

- b) which represent circles or cubics,

A, B
✓✓

- c) whose graphs have domains that exist for all real values,

B, H
✓✓

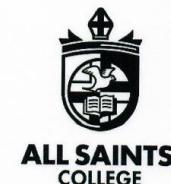
- d) whose graphs have asymptotes.

D, E, G
✓✓

ALL 3 FOR 2 MARKS
-1 FOR MISSING OR
INCORRECT GRAPHS

[8 Marks]

End of Test



MATHEMATICS DEPARTMENT

Year 11 Methods - Test Number 1b
Functions and Graphs
Resource Rich

Name: SOLUTIONS

Teacher: _____

Marks: 20

Time Allowed: 15 minutes

Instructions: You ARE allowed your calculator(s) but NO NOTES.

You will be supplied with a formula sheet.