MATHEMATICS DEPARTMENT

Year 11 Methods - Test Number 2 2019

Functions & Equations

Resource Free Section

Name: SOLUTIONS

Teacher: ____________________

Marks: 23

Time Allowed: 20 minutes

Instructions: You ARE NOT permitted any notes or calculator.

The formula sheet will be provided.

---

1. [2, 3, 4, 3 = 12 marks]

a) Solve the following equations:

(i) $12x^2 = 4x$.

$12x^2 - 4x = 0$

$4x(3x-1) = 0$ ✓

$x = 0$ or $x = \frac{1}{3}$. ✓

(ii) $x(x-2) = 35$.

$x^2 - 2x - 35 = 0$ ✓

$(x-7)(x+5) = 0$ ✓

$x = 7$ or -5. ✓

b) One solution to the equation $x^3 + 36 = 5x^2 + 12x$ is $x = 2$. Determine all other solutions.

$x^3 - 5x^2 - 12x + 36 = 0$

$(x-2)(x^2 - 3x - 18) = 0$

$(x-2)(x-6)(x+3) = 0$

$x = 2$ or 6 or -3. ✓

✓ equate to 0 and writes $(x-2)$ as factor

✓✓ finds quadratic expression

c) The curve $y = x^2 + 4x + 2k$ has two real and different zeroes. Find the value(s) of k.

$\Delta = 16 - 4(1)(2k) > 0$ ✓ ✓ must state

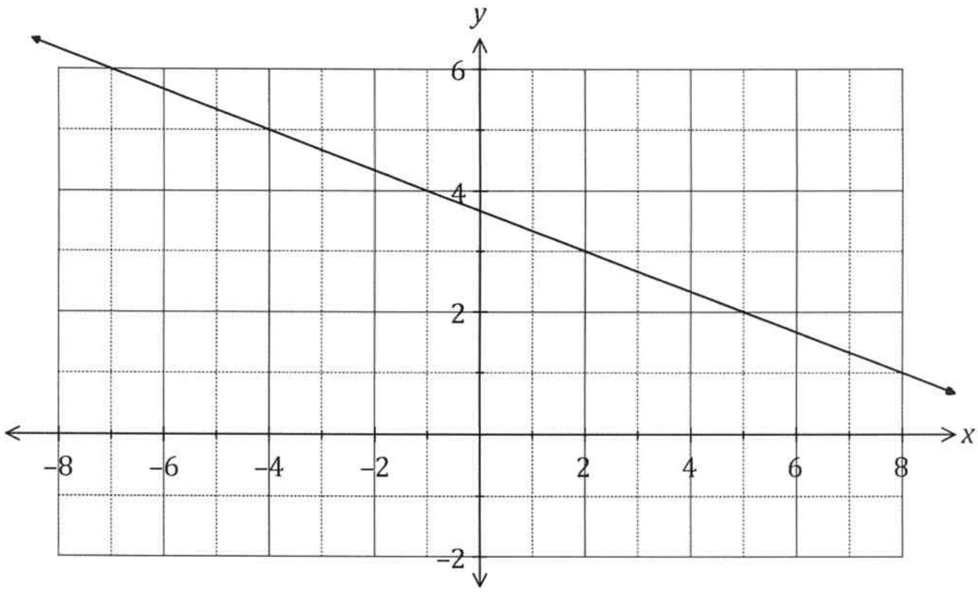
$16 - 8k > 0$

$-8k > -16$

$k < 2$ ✓

2. [2, 3 = 5 marks]

The graph of the line L_1 is shown below.



a) Determine the equation of L_1.

$m = -\frac{1}{3}$ ✓

$\therefore y = -\frac{1}{3}x + c$

Sub $(2, 3)$ $\quad 3 = -\frac{2}{3} + c$

$\therefore c = 3\frac{2}{3}$

$\therefore y = -\frac{1}{3}x + 3\frac{2}{3}.$ ✓

Two points are located at $A(-15, 15)$ and $B(9, 27)$.

b) Line L_2 is perpendicular to L_1 and passes through the mid-point of A and B. Determine the equation of L_2.

L_2: $m = 3$ ✓ $\qquad$ midpoint $AB = (-3, 21)$ ✓

$y = 3x + c$

$\therefore$ sub $(-3, 21)$: $\quad 21 = -9 + c$

$c = 30$

L_2: $\quad y = 3x + 30.$ ✓

3. [1, 2, 3 = 6 marks]

A function is defined by $f(x) = \sqrt{3x}$.

a) Calculate $f(12)$.

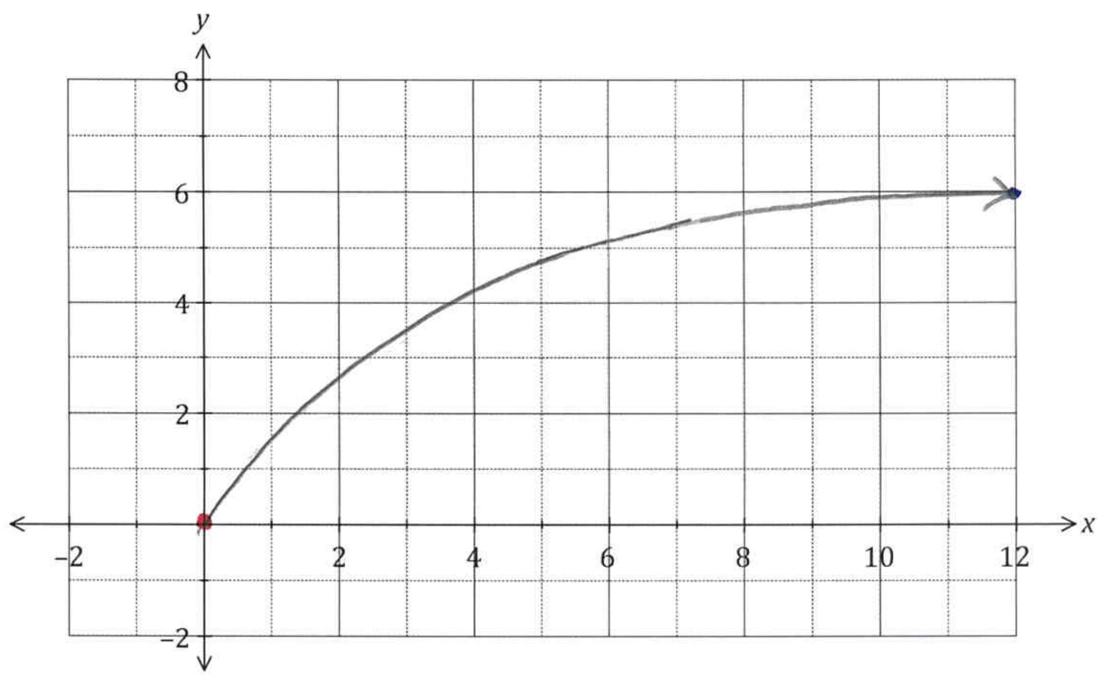
$f(12) = 6$ ✓

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

D: $\{x \mid x \geq 0, x \in R\}$ ✓ don't insist

R: $\{y \mid y \geq 0, y \in R\}$. ✓ on set notation

c) Sketch the graph of $y = f(x)$ on the axes below.



✓ origin

✓ through (12, 6) and basic shape

✓ smooth curve

MATHEMATICS DEPARTMENT

Year 11 Methods - Test Number 2 2019
Functions & Equations

Resource Rich Section

ALL SAINTS' COLLEGE

Name: SOLUTIONS Teacher: ____________

Marks: 24

Time Allowed: 25 minutes

Instructions: You ARE allowed calculators but NO notes. The formula sheet will be provided.

You must show your working where appropriate to receive full marks.

---

1. [4 marks]

The area of a sector is $\frac{3\pi}{10}\ cm^2$ and the arc length cut off by the sector $\frac{\pi}{5}\ cm$. Find the angle subtended at the centre of the circle and the radius of the circle.

$$\frac{3\pi}{10} = \frac{1}{2}r^2\theta \quad — ① \ ✓$$

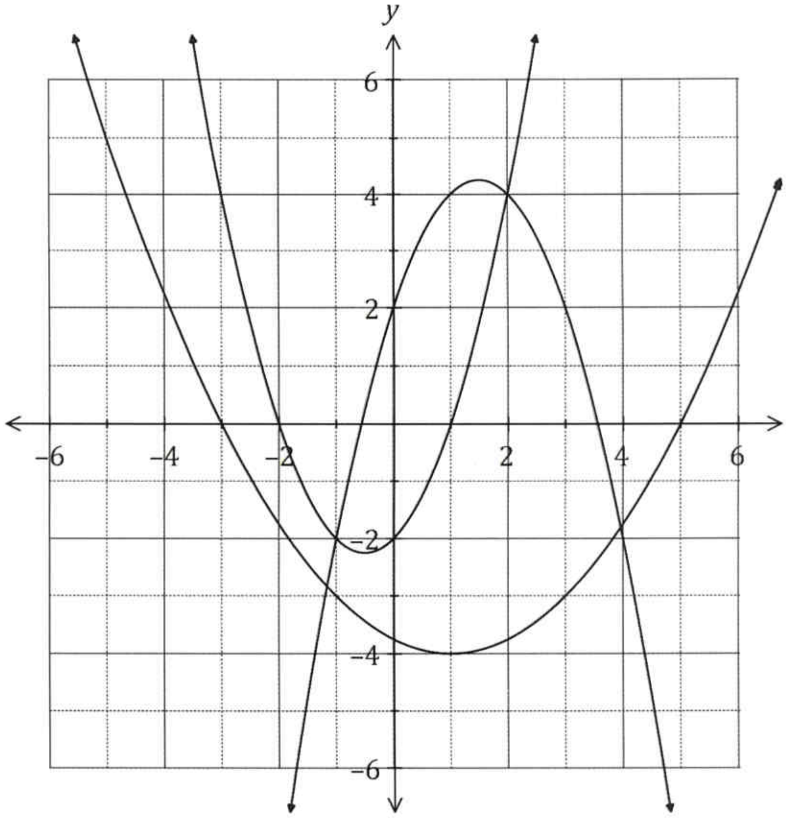
$$\frac{\pi}{5} = r\theta \quad — ② \ ✓$$

$$\therefore \theta = \frac{\pi}{15}^R \ ✓$$

$$r = 3\text{ cm} \ ✓$$

2. **[4 marks]**

The graphs of $y = -x^2 + 3x + c$, $y = a(x-1)^2 - 4$ and $y = (x+b)(x+2)$ are shown below.



Determine the values of the constants a, b and c.

$c = 2$

$b = -1$

sub $(5,0)$ into $y = a(x-1)^2 - 4$

$0 = a(5-1)^2 - 4$

$0 = 16a - 4$

$\therefore a = \frac{1}{4}$

3. **[2 marks]**

Determine the equation of the axis of symmetry for the graph of $y = -2x^2 - 12x - 37$.

(2 marks)

$x = -\frac{b}{2a} = \frac{12}{2(-2)} = -3.$

must have $\underline{\underline{x =}}$

4. [1, 4, 1, 1, 2 = 9 marks]

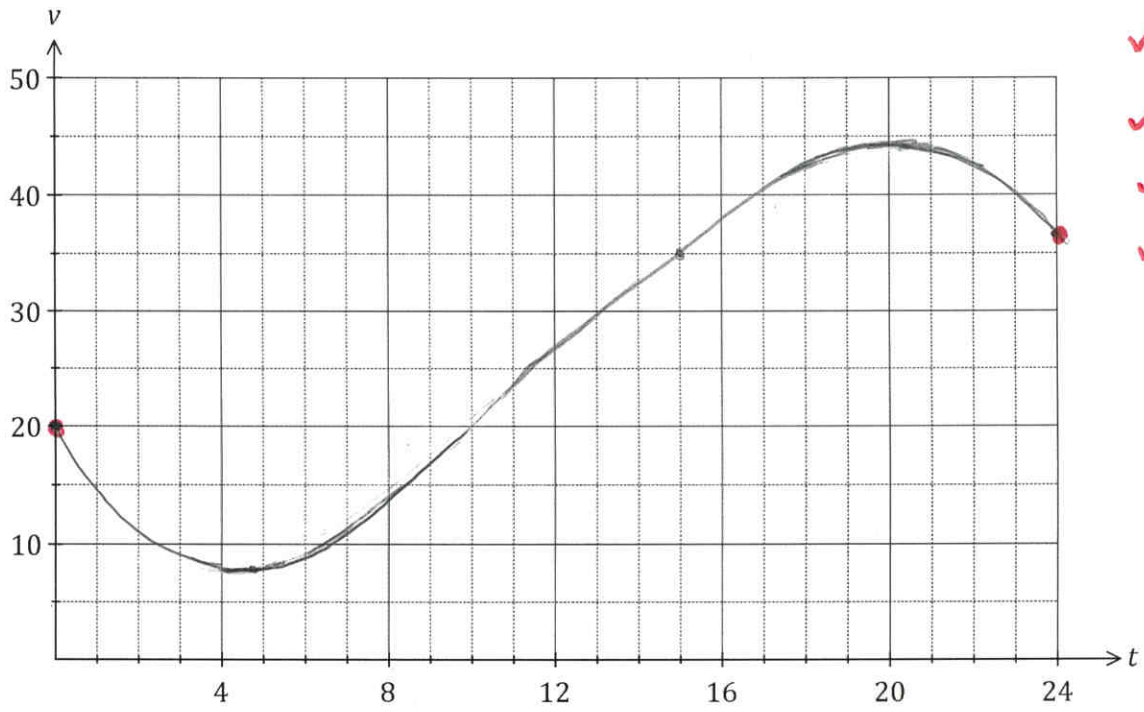
The wind speed at a weather station, v metres per second, t hours after recording began, can be modelled by the function

$$v = 20 - 5.8t + 0.75t^2 - 0.02t^3, 0 \leq t \leq 24$$

a) Calculate the wind speed when $t = 11$.

20.33 m/s ✓

b) Sketch the graph of wind speed against time on the axes below.



✓ endpoints
✓ max
✓ min
✓ curve

c) During the 24-hour period, determine

(i) the time at which the wind speed was greatest.

max v when t = 20.2 hours ✓

(ii) the minimum wind speed.

7.23 m/s ✓

(iii) the length of time, in hours and minutes, that the wind speed was increasing.

between min and max

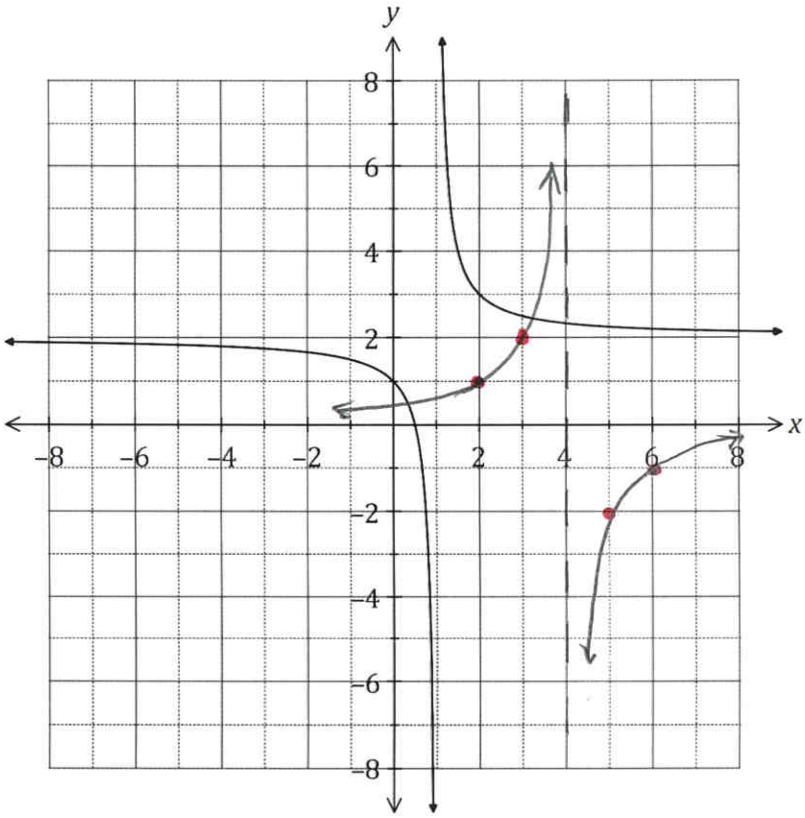
20.2h − 4.8h = 15.4 h ✓

= 15h 24min ✓ accept ± 2 min

5. [3, 2 = 5 marks]

Let $f(x) = \frac{2}{4-x}$ and $g(x) = \frac{1}{x+p} + q$, where p and q are constants.

The graph of $y = g(x)$ is shown below.



✓ shows asymptote $x = 4$

✓ y-int

✓ accuracy

a) Sketch the graph of $y = f(x)$ on the axes above.

b) Determine the values of p and q.

$q = 2$ ✓

$p = -1$ ✓

****End of Test****