

Q3

$$\begin{aligned} & \text{Solve } x^3 + 4x^2 + x - 6 = 0. \\ & \text{Factorization: } (x+2)(x+3)(x-1) \\ & \text{Roots: } x = -2, -3, 1 \end{aligned}$$

(3 marks)

$$\begin{array}{r} (x+2)(x+3)(x-1) \\ \hline x^3 + 4x^2 + x - 6 \\ x^3 + 3x^2 + 2x \\ \hline -x^2 - x - 6 \\ -x^2 - 3x - 2 \\ \hline 2x + 4 \\ 2x + 6 \\ \hline -2 \end{array}$$

$$\begin{aligned} & \text{Factorization: } (x-2)(x+1)^2 \\ & \text{Roots: } x = 2, -1, -1 \end{aligned}$$

(3 marks)

$$\begin{aligned} & \text{Solve } x^2 + 24x - 25 = 0. \\ & \text{Factorization: } (x+25)(x-1) = 0 \\ & \text{Roots: } x = 1, -25 \end{aligned}$$

(2 marks)

Attempt all questions.

(8 marks)

Name of student: ... (Name) ...
Total marks available: 35
Time Allowed: (5+25) minutes

Section One (Calculator Free)

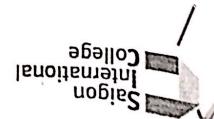
Test 1

Year 11 Mathematics Methods ATAR

2022

Semester 1, 2022
Department of Mathematics and Science

Saigon International College



Question 2


The point $(3, 4)$ is the midpoint of point $(-1, 5)$ and point S .

(a) Determine the coordinates of point S . (2 marks)

$$\left\{ \begin{array}{l} \frac{-1 + x}{2} = 3 \\ -1 + x = 6 \\ x = 7 \end{array} \right.$$

$$\begin{aligned} \frac{5 + y}{2} &= 4 \\ 5 + y &= 8 \\ y &= 3 \end{aligned}$$

$\boxed{(7, 3)}$

(b) Determine the equation of the straight line that passes through point $(2, -1)$ and is perpendicular to the line through points R and M . (3 marks)

$M(3, 4)$ $R(-1, 5)$ $S(7, 3)$

$$\begin{aligned} y &= mx + c \\ y - 5 &= m(x - 2) \\ 5 - 4 &= m(7 - 3) \\ 1 &= m \\ 5 - 4 &= m(-1 - 2) \\ 1 &= m - 4 \\ m &= \frac{1}{-4} \end{aligned}$$

$$\begin{aligned} y &= \frac{1}{-4}x + c \\ -1 &= \frac{1}{-4}(2) + c \\ -1 &= -\frac{1}{2} + c \\ -1 + \frac{1}{2} &= c \\ -\frac{1}{2} &= c \end{aligned}$$

$$\frac{1}{-0.25} = 4$$

$$\begin{aligned} y &= bx + c \\ -1 &= b(2) + c \\ -1 &= 8 + c \\ -1 - 8 &= c \\ -9 &= c \end{aligned}$$

$\boxed{y = 4x - 9}$

Answer

2

$$\begin{aligned} y &= bx + c \\ -1 &= b(2) + c \\ -1 &= 8 + c \\ -1 - 8 &= c \\ -9 &= c \end{aligned}$$

$\boxed{y = 4x - 9}$

4

①

②

(b) $G(x) = \sqrt{x - 4}$

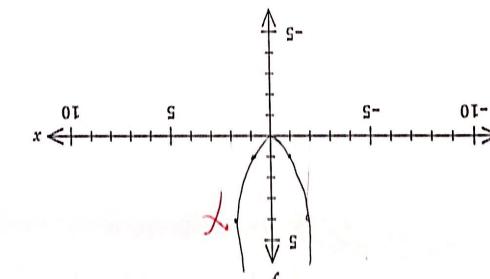
(a) $F(x) = 5 + x^2$

State the domain and corresponding range for the following functions.

Question 4

(4 marks)

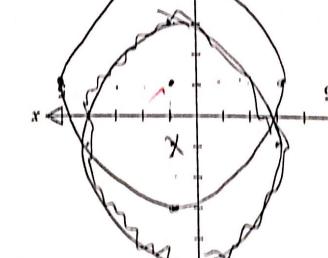
3



(2 marks)

(b) Sketch the graph of $y^2 = x$ on the axes below.

①



(3 marks)

(7 marks)

(a) Sketch the graph of $(x-1)^2 + (y+1)^2 = 4$ on the axes below.

Question 3

Answers

3

3

If we take vertical line $x=4$
 ~~$y^2 = x$~~ is a function if x because $y^2 = x$ passes

(c) Explain whether y is a function of x in the relationship graphed in (b). (2 marks)

Question 5

(4 marks)

Consider the line $2x + by = c$ where c is a constant.(a) Find b if the line has gradient -4.

$$\begin{aligned} 2x + by &= c \\ by &= -2x + c \\ y &= \frac{-2x}{b} + \frac{c}{b} \end{aligned}$$

(2 marks)

gradient: $\frac{-2}{b} = -4$

$$\begin{aligned} -2 &= b \\ -4 &= b \\ b &= 0.6 \end{aligned}$$

(b) Find the c if this line has an X-intercept of 6.

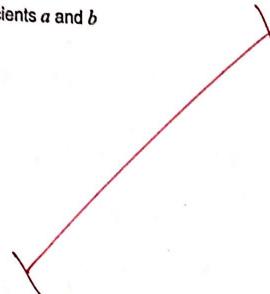
(2 marks)

$$\begin{aligned} y &= 0.5x + c \\ 0 &= 0.5(6) + c \\ 0 &= 3 + c \\ -3 &= c \end{aligned}$$

Y

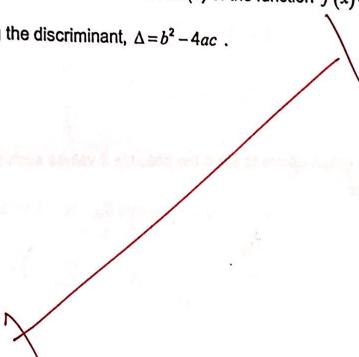
(i) Express the cubic in the form $x^3 - 3x^2 - 3x + 14 = (x+2)(x^2 + ax + b)$ evaluating the coefficients a and b

(2 marks)



(ii) Hence, state the number of real root(s) of the function $f(x) = x^3 - 3x^2 - 3x + 14$. Justify your answer using the discriminant, $\Delta = b^2 - 4ac$.

(4 marks)

**End of Section Two**

6

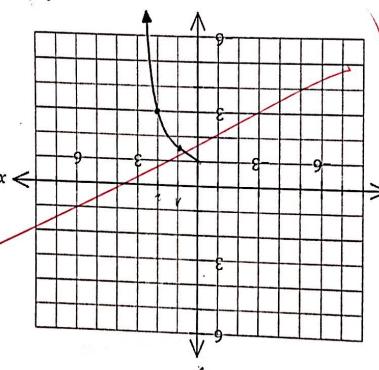
End of section one

(3 marks)

$$\textcircled{1} \quad a = 3x - 1$$

$$-3 = \frac{a}{2-3}$$

$$y = \frac{ax}{2-3}$$



$$y = \frac{3}{2}x$$

$$y = x$$

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

$$y = \frac{1}{3}x$$

$$y = \frac{1}{4}x$$

$$y = \frac{1}{5}x$$

$$y = \frac{1}{6}x$$

$$y = \frac{1}{7}x$$

$$y = \frac{1}{8}x$$

$$y = \frac{1}{9}x$$

$$y = \frac{1}{10}x$$

$$y = \frac{1}{11}x$$

$$y = \frac{1}{12}x$$

$$y = \frac{1}{13}x$$

$$y = \frac{1}{14}x$$

$$y = \frac{1}{15}x$$

$$y = \frac{1}{16}x$$

$$y = \frac{1}{17}x$$

$$y = \frac{1}{18}x$$

$$y = \frac{1}{19}x$$

$$y = \frac{1}{20}x$$

$$\text{(c) Part of the graph of } y = \frac{x-3}{a} \text{ is drawn below.}$$

$$t = 0.02$$

$$t = 0.12$$

$$t = 0.22$$

$$t = 0.32$$

$$t = 0.42$$

$$t = 0.52$$

$$t = 0.62$$

$$t = 0.72$$

$$t = 0.82$$

$$t = 0.92$$

$$t = 1.02$$

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$$t = 18.62$$

$$t = 18.72$$

$$t = 18.82$$

$$t = 18.92$$

$$t = 19.02$$

Section Two (Calculator Assumed)

Time Allowed: (5 + 55) minutes

marks

Student's Name: ... Chuu... Anh.Dung 11A

Total Mark available. 51

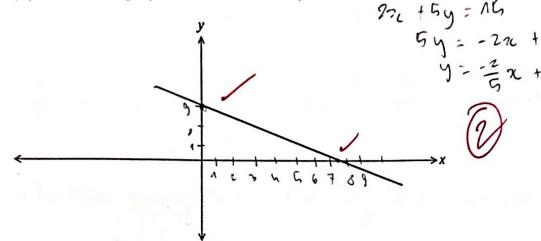
35

Question 7 (6 marks)

The variables x and y are related by the equation $2x + 5y = 15$.

(a) Sketch the graph of this relationship.

(2 marks)



(b) Express y in terms of x and briefly explain why y is a function of x . (2 marks)

$$y = -\frac{2}{5}x + 3 \quad \text{①}$$

because it passes the vertical line test,

there are no repeated x \checkmark ①

(c) The domain of x is restricted to $5 \leq x < 10$. State the range of y . (2 marks)

range: $y \geq -1$ $y \leq 1$

$$\begin{aligned} 2x + 5y &= 15 \\ 10 + 5y &= 15 \\ 5y &= 5 \\ y &= 1 \end{aligned}$$

②

$$\begin{aligned} 2x(10) + 5y &= 15 \\ 20 + 5y &= 15 \\ 5y &= -5 \\ y &= -1 \end{aligned}$$

1

Question 12 (6 marks)

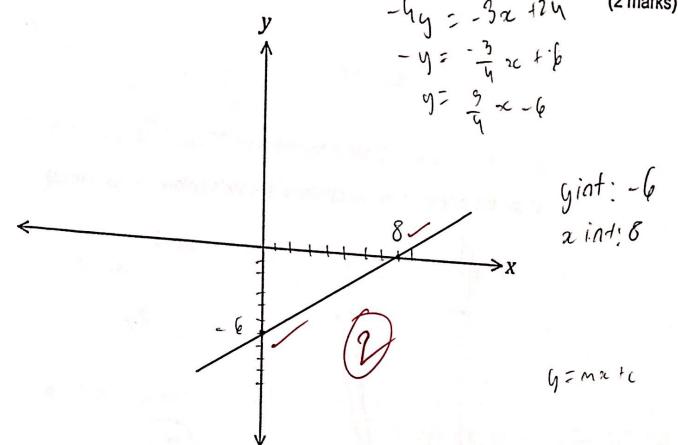
Line L_1 has equation $3x - 4y = 24$.

(a) Sketch the graph of L_1 .

$$\begin{aligned} -4y &= -3x + 24 \\ y &= \frac{3}{4}x - 6 \end{aligned}$$

$y_{int} = -6$
 $x_{int} = 8$

$$y = mx + c$$



(b) Determine the equation of the line L_2 that is parallel to L_1 and passes through the point with coordinates $(-2, -3)$. (2 marks)

$$y = \frac{3}{4}x - 6 \quad \text{①}$$

$$y = \frac{3}{4}x - c$$

$$-3 = \frac{3}{4}(-2) - c$$

$$-3 = -1.5 - c$$

$$-3 = -1.5 - c$$

$$\begin{aligned} -1.5 &= c \\ c &= -1.5 \quad \text{①} \end{aligned}$$

$$y = \frac{3}{4}x - 1.5$$

$$y = \frac{3}{4}x - 1.5$$

(c) Determine the equation of the line L_3 that is perpendicular to L_1 and has the same y intercept as L_1 . (2 marks)

$$\begin{aligned} y_{int} &= -6 \\ m &= -\frac{4}{3} \quad \text{①} \end{aligned}$$

$$-6 = \frac{4}{3}(0) + c$$

$$-6 = c$$

$$y = -\frac{4}{3}x - 6 \quad \text{①}$$

$$\begin{aligned} \text{① } & \frac{1}{2}x^2 - 14x + 42 = 0 \\ & x_1 = 6, x_2 = 14 \\ & 2q = -34 \\ & q = -17 \\ & 1060 + 2q = 42 \\ & 1060 + 2(-17) = 42 \\ & 1060 - 34 = 42 \\ & 1026 = 42 \\ & p = 21 \\ & 5p + 2q = 42 \\ & 5p + 2(-17) = 42 \\ & 5p - 34 = 42 \\ & 5p = 76 \\ & p = 15.2 \\ & \text{find } y: \\ & 5p + 2q = 42 \\ & 5(15.2) + 2(-17) = 42 \\ & 76 - 34 = 42 \\ & 42 = 42 \end{aligned}$$

(b) The points D and E have coordinates $(5p, -q)$ and $(2q, p)$, respectively, where p and q are constants. Determine the value of p and the value of q if the midpoint of D and E is at $(21, 17)$.

$$\begin{aligned} \text{① } & 4 + 2q = 21 \\ & 2q = 17 \\ & q = 8.5 \\ \text{② } & 5p - 34 = 17 \\ & 5p = 51 \\ & p = 10.2 \\ & \text{find } y: \\ & 5p + 2q = 42 \\ & 5(10.2) + 2(8.5) = 42 \\ & 51 + 17 = 42 \\ & 68 = 42 \end{aligned}$$

(a) The points A and B have coordinates $(4, -6)$ and $(5, 8)$ respectively. If B is the midpoint of A and C, determine the coordinates of C.

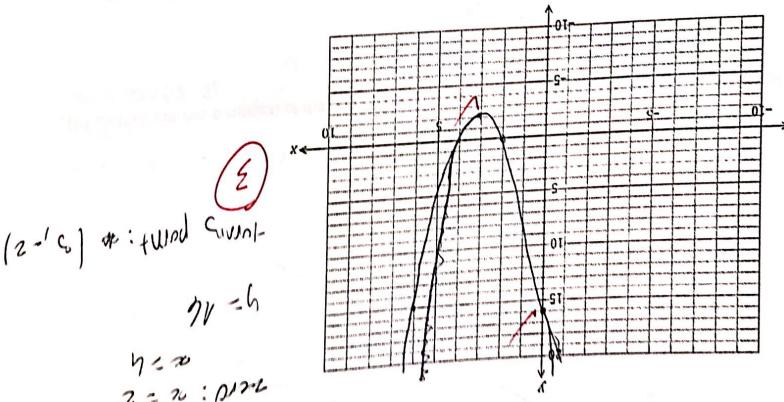
Question 8

(e) The graph of $y = 2x^2 + bx + 16$ has a line of symmetry with equation $x = 3$.
 (6 marks)

$$\begin{aligned} \text{① } & 2x^2 + bx + 16 = 0 \\ & x = 3 \text{ is the vertex} \\ & 2(3)^2 + b(3) + 16 = 0 \\ & 18 + 3b + 16 = 0 \\ & 3b = -34 \\ & b = -\frac{34}{3} \\ & b = -11.33 \\ & \text{the value of } c \text{ and all other solutions.} \\ \text{② } & 2x^2 + 21x + 495 = 0 \\ & x = 5 \text{ is the vertex} \\ & 2(5)^2 + 21(5) + 495 = 0 \\ & 50 + 105 + 495 = 0 \\ & 650 = 0 \end{aligned}$$

(b) One of the solutions to the equation $2x^3 + 21x^2 + cx - 495 = 0$ is $x = 5$. Determine the value of c and all other solutions.

(3 marks)
 (a) The graph of $y = 2x^3 + 21x^2 + cx - 495 = 0$ is shown below. Determine the value of c .



ii. Draw the graph of the parabola on the axes below. (3 marks)

$$\begin{aligned} \text{① } & y = 2x^2 - 12x + 16 \\ & y = 2(x^2 - 6x + 8) \\ & y = 2(x - 2)(x - 4) \\ & \text{graph: } \end{aligned}$$

(a) The graph of $y = 2x^2 + bx + 16$ has a line of symmetry with equation $x = 3$.
 (2 marks)

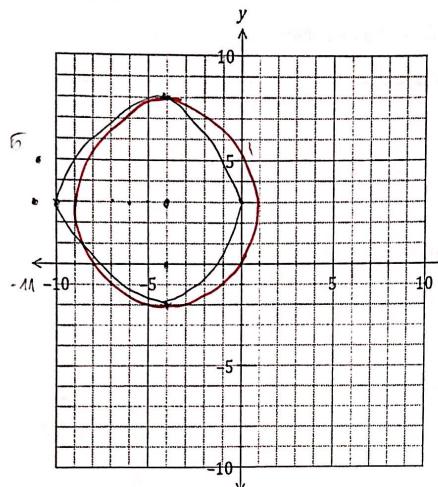
1. Determine the value of b .
 (6 marks)

Question 11

(e) The graph of $y = 2x^2 + bx + 16$ has a line of symmetry with equation $x = 3$.
 (6 marks)

Question 9

- (a) The variables x and y are related by $(x + 4)^2 + (y - 3)^2 = 25$.
 (i) Sketch the graph of this relationship.



(6 marks)

(3 marks)

①

- (ii) How does the vertical line test indicate that y is not a function of x ? (1 mark)

The vertical line test infers the graph two times,
 so it is not a function ①

- (b) The graph of $(x + 4)^2 + (y - 3)^2 = 25$ that you made in (a) is moved left 7 units and up 2 units.
 What will be the equation of the graph in its new location? (2 marks)

$$(x + 11)^2 + (y - 5)^2 = 25$$

①

3

Question 10

(6 marks)

The graph $y = f(x)$, where $f(x) = x^2 + bx + c$ has a turning point at $(-2, -1)$.

- (a) State the equation of the line of symmetry for the graph of $y = f(x)$. (1 mark)

$$x = -2$$
①

- (b) Determine the value of the constant b and the value of the constant c . (3 marks)

$$y = x^2 + bx + c$$

$$-1 = 4 + b(-2) + c$$

$$-1 = 4 - 2b + c$$

~~use turning point form~~

$$y = a(x - b)^2 + c$$

$$y = (x + 2)^2 - 1 \quad \text{①}$$

$$y = x^2 + 4x + 4 - 1$$

$$y = x^2 + 4x + 3$$

$$\boxed{b = 4} \quad \boxed{c = 3}$$

- (c) The graph of $y = f(x)$ is translated 3 units to the right and 5 units upwards. Determine the equation of the resulting curve. (2 marks)

turning point
 $(1, 4)$

$$y = (x - 1)^2 + 4$$
②

$$y = x^2 - 2x + 1 + 4$$

$$y = x^2 - 2x + 5$$
②

4