

FUNCTIONS TEST A

Grade 10 Mathematics

Marks: 75

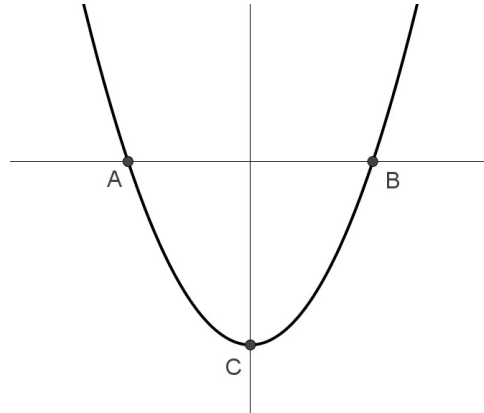
Time: 1,5 hours

Name: _____ **MEMORANDUM** _____



QUESTION 1

Sketched below is the graph of $f(x) = x^2 - 9$



1.1 Determine the coordinates of A, B and C.

(4) S1209

$$y - \text{int: } x = 0$$

$$C(0; -9) \quad \checkmark$$

$$x - \text{int: } y = 0$$

$$0 = x^2 - 9$$

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

$$x = -3 \text{ or } x = 3 \quad \checkmark$$

$$A(-3; 0) \quad \checkmark \quad B(3; 0) \quad \checkmark$$

1.2 What is the equation of the axis of symmetry?

(1) S1204

$$x = 0 \quad \checkmark$$

1.3 What are the coordinates of the turning point?

(1) S1204

$$C(0; -9) \quad \checkmark$$

1.4 What is the domain of $f(x)$?

(2) S1206b

$$x \in \mathbb{R} \quad \checkmark \quad \checkmark$$

1.5 What is the range of $f(x)$?

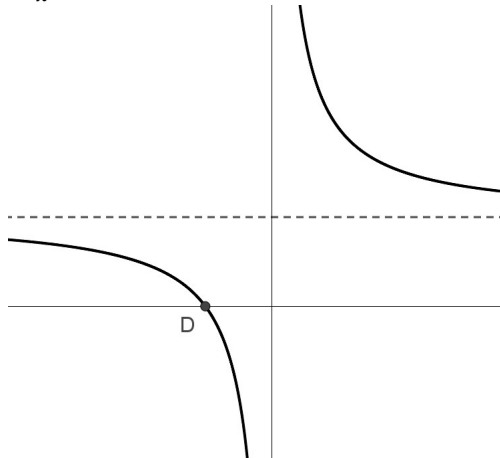
(2) S1206b

$$y \in [-9; \infty) \quad \text{OR} \quad y \geq -9; y \in \mathbb{R} \quad \checkmark \quad \checkmark$$

[10]

QUESTION 2

Consider the function $g(x) = \frac{3}{x} + 2$ sketched below.



2.1 Determine the coordinates of D.

(3) S1209

$x - \text{int: } y = 0$

$0 = \frac{3}{x} + 2$

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

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

$D\left(-\frac{3}{2}; 0\right)$

2.2 What are the equations of the asymptotes?

(2) S1204

$x = 0$

$y = 2$

2.3 What are the equations of the axis of symmetry?

(2) S1204

$y = x + 2$

$y = -x + 2$

2.4 Write down the domain of $g(x)$.

(2) S1206b

$x \in \mathbb{R}; x \neq 0$

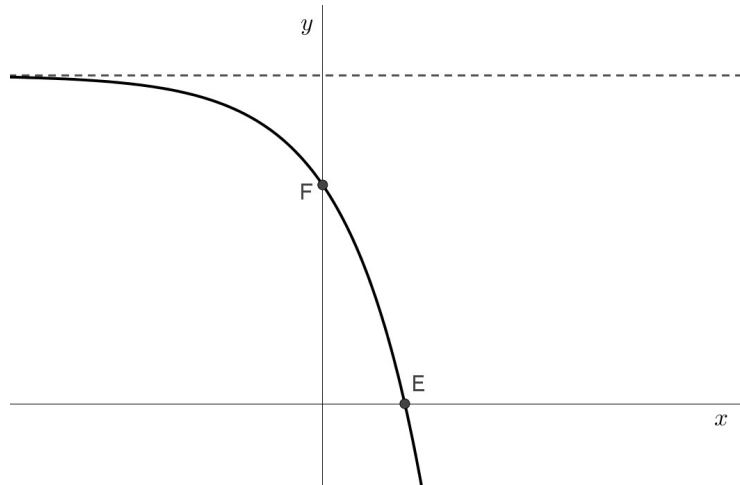
2.5 Write down the range of $g(x)$.

(2) S1206b

$y \in \mathbb{R}; y \neq 2$

QUESTION 3

Sketched below is the graph of $h(x) = -4 \cdot 3^x + 12$



3.1 Determine the coordinates of E and F.

(6) S1209

$$x - \text{int}: y = 0$$

$$0 = -4 \cdot 3^x + 12$$

$$-12 = -4 \cdot 3^x$$

$$3 = 3^x$$

$$\therefore x = 1$$

$$E(1; 0)$$

$$y - \text{int}: x = 0$$

$$y = -4 \cdot 3^0 + 12$$

$$= -4(1) + 12$$

$$= -4 + 12$$

$$= 8$$

$$F(0; 8)$$

3.2 Write down the equation of the asymptote.

(1) S1204

$$y = 12$$

3.3 What is the domain of $h(x)$?

(2) S1206b

$$x \in \mathbb{R}$$

3.4 What is the range of $h(x)$?

(2) S1206b

$$y \in (-\infty; 12) \quad \text{OR} \quad y < 12; y \in \mathbb{R}$$

[11]

QUESTION 4

Sketch the following graphs on the given set of axes. Show all intercepts with the axes as well as any asymptotes, axis of symmetries or turning points:

S1202
S1207

4.1 $y = 3x - 6$

(3)

Shape: 

$x - \text{int: } y = 0$

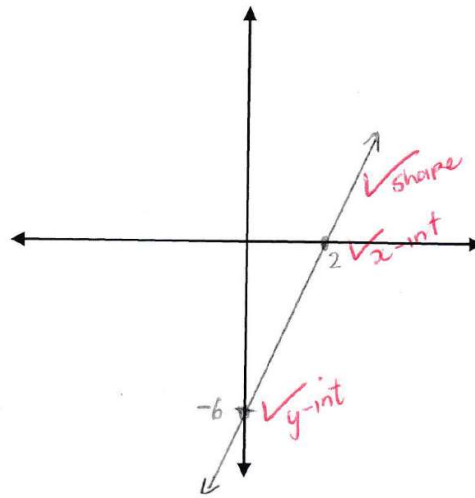
$0 = 3x - 6$

$6 = 3x$

$x = 2$

$y - \text{int: } x = 0$

$y = -6$



4.2 $y = -x^2 + 25$

(4)

Shape: 

$x - \text{int: } y = 0$

$0 = -x^2 + 25$

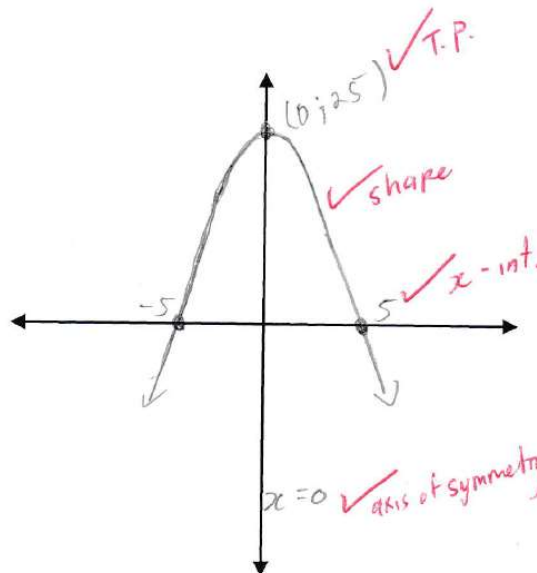
$x^2 - 25 = 0$

$(x + 5)(x - 5) = 0$

$x = -5$ or $x = 5$

$y - \text{int: } q - \text{value}$

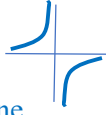
$y = 25$



4.3 $y = \frac{-3}{x} - 1$

(5)

Shape:



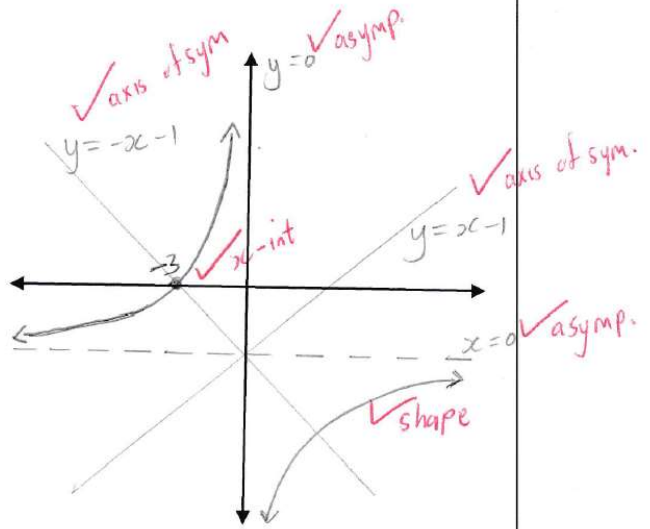
y - int: none

x - int: $y = 0$

$$0 = \frac{-3}{x} - 1$$

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

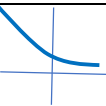
$$x = -3$$



4.4 $y = \left(\frac{1}{2}\right)^x + 1$

(3)

Shape:



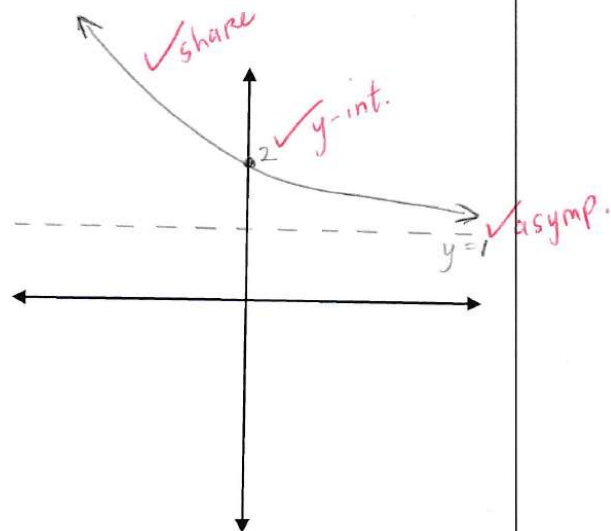
x - int: none

y - int: $x = 0$

$$y = \left(\frac{1}{2}\right)^0 + 1$$

$$y = 1 + 1$$

$$y = 2$$

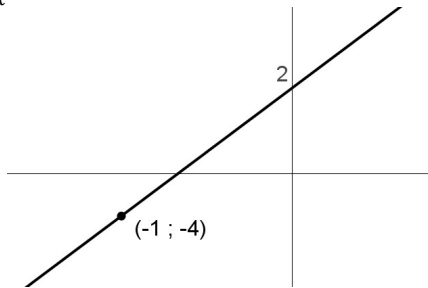


QUESTION 5

Determine the equations of the following functions in the form of $y = mx + c$, $y = ax^2 + q$, $y = \frac{a}{x} + q$ or $y = k^x + q$.

S1203
S1208

5.1



$$y = mx + c$$

$$c = 2 \quad \checkmark$$

Subs $(-1; -4)$

$$-4 = m(-1) + 2$$

$$-4 - 2 = -m$$

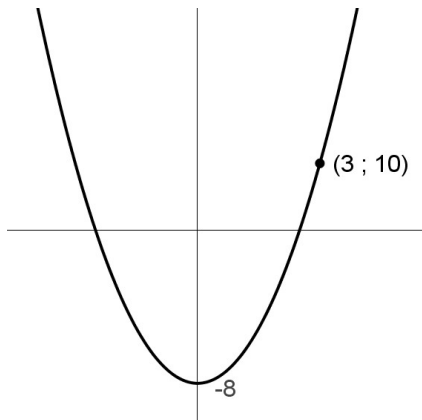
$$-6 = -m$$

$$m = 6 \quad \checkmark$$

$$\therefore y = 6x + 2 \quad \checkmark$$

(3)

5.2



$$y = ax^2 + q$$

$$q = -8 \quad \checkmark$$

Subs $(3; 10)$

$$10 = a(3)^2 - 8$$

$$10 + 8 = 9a$$

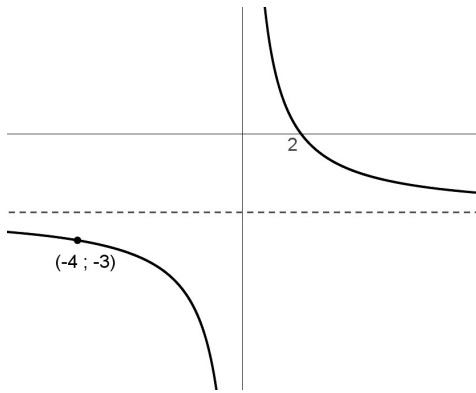
$$18 = 9a$$

$$a = 2 \quad \checkmark$$

$$\therefore y = 2x^2 - 8 \quad \checkmark$$

(3)

5.3



$$y = \frac{a}{x} + q$$

(4)

Subs (2; 0)

$$0 = \frac{a}{2} + q$$

$$0 = a + 2q \dots \textcircled{1} \Rightarrow a = -2q$$

Subs (-4; -3)

$$-3 = \frac{a}{-4} + q$$

$$12 = a - 4q \dots \textcircled{2} \quad \checkmark$$

Subs $\textcircled{1}$ into $\textcircled{2}$:

$$12 = -2q - 4q$$

$$12 = -6q$$

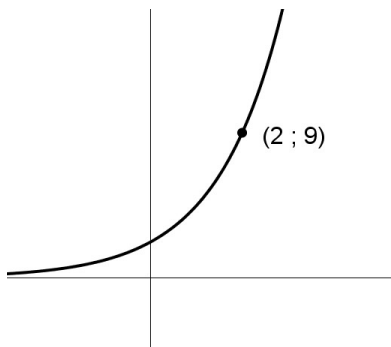
$$q = -2 \quad \checkmark$$

$$a = -2(-2)$$

$$= 4 \quad \checkmark$$

$$\therefore y = \frac{4}{x} - 2 \quad \checkmark$$

5.4



$$y = k^x + q$$

(3)

$$q = 0 \quad \checkmark$$

Subs (2; 9)

$$9 = k^2 + 0$$

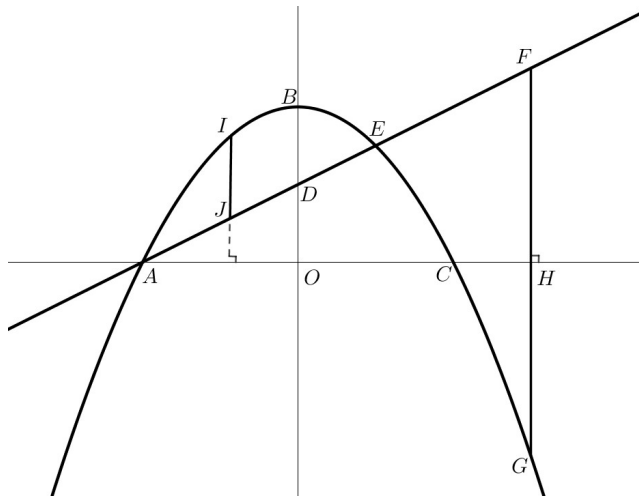
$$k^2 = 9$$

$$k = 3 \quad \checkmark$$

$$\therefore y = 3^x \quad \checkmark$$

QUESTION 6

Given below are the graphs of $f(x) = -x^2 + 4$ and $g(x) = x + 2$



6.1 Determine the average gradient of $f(x)$ between $x = 1$ and $x = 3$.

(4) S1205

$$f(x) = -x^2 + 4$$

$$f(1) = -(1)^2 + 4 = 3 \therefore (1; 3)$$

$$f(3) = -(3)^2 + 4 = -5 \therefore (3; -5)$$

$$\begin{aligned} m_{ave} &= \frac{f(x_2) - f(x_1)}{x_2 - x_1} \\ &= \frac{3 - (-5)}{1 - 3} \\ &= -4 \end{aligned}$$

6.2 Determine the coordinates of A and E

(5) S1209

(where the graphs intercept)

$$\therefore f(x) = g(x)$$

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

$$-x^2 - x + 4 - 2 = 0$$

$$x^2 + x - 2 = 0$$

$$(x + 2)(x - 1) = 0$$

$$x = -2 \quad \text{or} \quad x = 1$$

$$y = -2 + 2 \quad y = 1 + 2$$

$$y = 0 \quad y = 3$$

$$\therefore A(-2; 0)$$

$$\therefore E(1; 3)$$

6.3 Given that OH is 3 units, determine the length of FG.

(3) S1209

$$g(3) = 3 + 2 \\ = 5 \quad \checkmark$$

$$f(3) = -(3)^2 + 4 \\ = -5 \quad \checkmark$$

$$FG = 5 - (-5) \\ = 10 \quad \checkmark$$

6.4 If it is given that IJ is 2 units, determine the coordinates of I.

(3) S1209

(Distance = "top graph" - "bottom graph")

$$IJ = f(x) - g(x) \\ 2 = -x^2 + 4 - (x + 2) \quad \checkmark$$

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

$$x^2 + x - 4 + 2 + 2 = 0$$

$$x^2 + x = 0$$

$$x(x + 1) = 0$$

$$x = 0 \quad \text{or} \quad x = \underline{-1} \quad \checkmark$$

$$f(-1) = -(-1)^2 + 4 \\ = 3$$

$$\therefore I(-1; 3) \quad \checkmark$$

[15]

Total: 75 Marks