

Unit 1  
Semester 1 2018  
Mathematics Methods Test 2

<b>Name</b>	
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**Full working out must be shown to get full marks.**

**Attempt all questions**

**Total Time: 60 minutes**

- |   |                   |                 |
|---|-------------------|-----------------|
| <b>• Section 1 (Calculator Free):</b>     | <b>45 minutes</b> | <b>45 marks</b> |
| <b>• Section 2 (Calculator Assisted):</b> | <b>10 minutes</b> | <b>10 marks</b> |

**Calculator Free**

**Question 1**

**(2, 2 - 4 marks)**

Find the gradient and y-intercept for each equation below.

a)  $3x - 4y = 12$

$$3x - 12 = 4y$$

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

$$m = \frac{3}{4}$$

$$y \text{ int} = (0, -3)$$

b)  $py - qx + 5 = 0$

$$py = qx - 5$$

$$y = \frac{q}{p}x - \frac{5}{p}$$

$$m = \frac{q}{p}$$

$$y \text{ int} = (0, -\frac{5}{p})$$

**Question 2**

**(4 marks)**

Identify which lines below are parallel and which are perpendicular.

**A**  $4x + 2y = 10$   
 $m = -2$

**D**  $2y = 4x + 10$   
 $m = 2$

**G**  $hy = gx - 12$   $m = \frac{g}{h}$

**B**  $hx - gy = 12$   
 $m = \frac{h}{g}$

**E**  $gx - hy = 12$   
 $m = \frac{g}{h}$

**H**  $x = 2y - 10$   
 $m = \frac{1}{2}$

**C**  $x - gy = \frac{12}{h}$   
Not linear

**F**  $3x - 4y = 12$   
 $m = \frac{3}{4}$

$A \perp H$  Perpendicular  
 $E \parallel G$  parallel.

**Question 3****(3 marks)**

Given the following function rules and the domains, find their corresponding ranges.

	Function Rule $f(x)$	Domain
a)	$4x - 3$	$-3 \leq x \leq 5$
b)	$x^2 - 4$	$-3 \leq x \leq 5$
c)	$\sqrt{x + 2}$	$-1 \leq x \leq 10$

a)  $\{y \in \mathbb{R}; -15 \leq y \leq 17\}$

b)  $\{y \in \mathbb{R}; -4 \leq y \leq 21\}$

c)  $\{y \in \mathbb{R}; 1 \leq y \leq \sqrt{12}\}$

**Question 4****(1 marks)**

A function is defined as  $f(x) = x^2 + 2x - 8$ . Write an expanded expression for  $f(2x)$

$$f(x) = (2x)^2 + 2(2x) - 8$$

$$= 4x^2 + 4x - 8$$

**Question 5****(1, 2, 2-5 Marks)**

A line passes through (3, 5) and (7, 25).

a) Find the gradient of this line

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{25 - 5}{7 - 3} = \frac{20}{4} = 5$$

b) Find the equation of this line

$$y = 5x + c \text{ at } (3, 5)$$

$$5 = 5(3) + c$$

$$5 = 15 + c$$

$$\therefore c = -10$$

$$\therefore y = 5x - 10$$

c) Is (4, 10) on this line? Justify your answer.

$$y = 5x - 10$$

$$10 = 5(4) - 10$$

$$10 = 10$$

$\therefore$  Does sit on the line.

# Question 8

(1, 1, 1, 2, 2 -7 marks)

Given the functions

$$f(x) = 2x - 3$$

$$h(x) = \sqrt{x+4}$$

$$g(x) = x^2 + 2x - 8$$

$$j(x) = 4 - \frac{x}{3}$$

determine

$$(a) \quad h(0) = \sqrt{0+4} \\ = 2. \quad \checkmark$$

$$(b) \quad g(-2) = (-2)^2 + 2(-2) - 8 \\ = -8. \quad \checkmark$$

$$(c) \quad f(2t-1) = 2(2t-1) - 3 \\ = 4t - 2 - 3 \\ = 4t - 5 \quad \checkmark$$

(c)  $x$  such that  $f(x) = j(x)$

$$2x - 3 = 4 - \frac{x}{3} \quad \checkmark$$

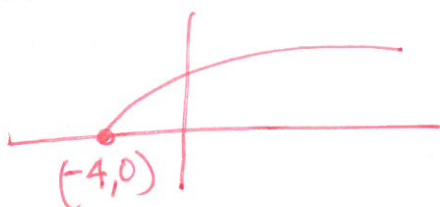
$$2x + \frac{x}{3} = 7.$$

$$\frac{7x}{3} = 7.$$

$$7x = 21$$

$$x = 3 \quad \checkmark$$

(d) the domain and range of  $h(x)$



Domain

$$x \in \mathbb{R}; x \geq -4 \quad \checkmark$$

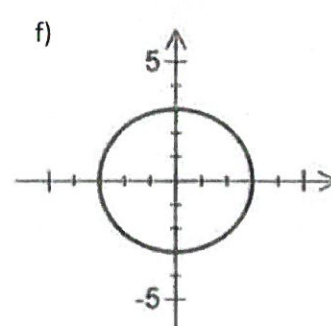
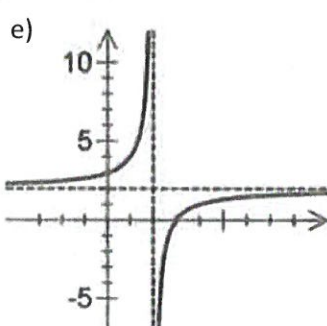
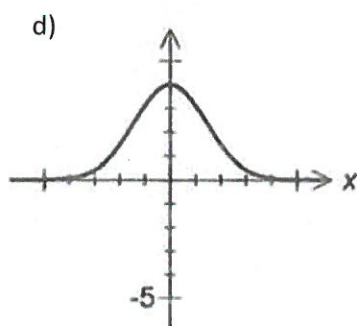
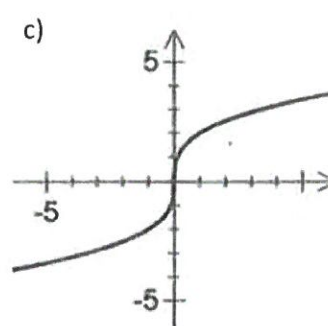
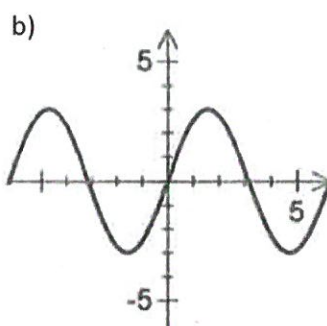
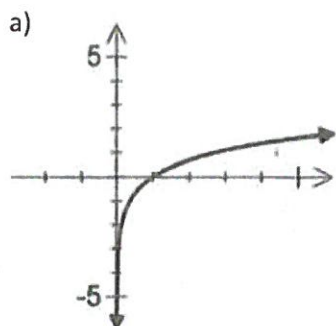
Range

$$y \in \mathbb{R}; y \geq 0. \quad \checkmark$$

# Question 6

(11 marks)

Shown below are the graphs of some mapping rules. Determine with **reasons** which of these rules are functions. Give the natural domain and range for those that are function rules.



a) Reason: 1 to 1 mapping is a function  
 Domain:  $\{x \in \mathbb{R}; x > 0\}$   
 Range:  $\{y \in \mathbb{R}\}$

d) Reason: 1 to 1 mapping.  
 Domain:  $\{x \in \mathbb{R}\}$   
 Range:  $\{y \in \mathbb{R}; 0 \leq y \leq 4\}$

b) Reason: 1 to 1 mapping is a function  
 Domain:  $\{x \in \mathbb{R}\}$   
 Range:  $\{y \in \mathbb{R}; -3 \leq y \leq 3\}$

e) Reason: 1 to 1 Mapping  
 Domain:  $\{x \in \mathbb{R}; x \neq 2\}$   
 Range:  $\{y \in \mathbb{R}; y \neq 2\}$

c) Reason: 1 to 1 mapping is a function  
 Domain:  $\{x \in \mathbb{R}\}$   
 Range:  $\{y \in \mathbb{R}\}$

f) Reason: Not a function  
 Vertical line rule.  
 Domain:  
 Range:



### Question 7

(4 marks)

Find the values of  $a$ ,  $b$  and  $c$ , given that the straight line  $ax + by = c$  passes through  $(-1, 4)$  and  $(2, 5)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{5 - 4}{2 - (-1)}$$

$$m = \frac{1}{3} \checkmark$$

$$y = mx + c$$

$$y = \frac{1}{3}x + c \text{ at } (2, 5)$$

$$5 = \frac{1}{3}(2) + c$$

$$c = \frac{12}{3} = 4\frac{1}{3}$$

$$\therefore \text{Equation} = y = \frac{1}{3}x + 4\frac{1}{3} \checkmark$$

$$\therefore a = 1$$

$$b = -3$$

$$c = -13 \checkmark$$

$$3y = x + 13$$

$$x - 3y = -13 \checkmark$$

### Question 8

(3, 3 - 6 marks)

Find the equation of the line through the point with coordinated  $(10, 3)$

a) and parallel to the line with the equation  $4x + 5y = 20$

$$\frac{5y = 20 - 4x}{5}$$

$$y = -\frac{4}{5}x + 4 \text{ at } (10, 3) \checkmark$$

$$m_1 = m_2$$

$$-\frac{4}{5} = -\frac{4}{5}$$

$$3 = -\frac{4}{5}(10) + c \checkmark$$

$$3 = -8 + c$$

$$c = 11$$

$$y = -\frac{4}{5}x + 11 \checkmark$$

b) and perpendicular to the line with equation  $2x + 3y = 12$

$$3y = 12 - 2x$$

$$y = -\frac{2}{3}x + 4$$

$$m_1 = -\frac{1}{m_2}$$

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

$$y = \frac{3}{2}x + c \text{ at } (10, 3)$$

$$3 = \frac{3}{2}(10) + c \checkmark$$

$$3 = 15 + c$$

$$c = -12$$

$$y = \frac{3}{2}x - 12 \checkmark$$



**Mathematics Methods**  
**Semester 1 2017**  
**Calculator Assumed**

**Question 10**

**(2, 1 – 3 marks)**

The owner of a shop that sells computers calculates that his total weekly profit is given by the rule:

$$\text{Total profit in dollars} = mx - c,$$

where  $\$m$  is the profit per computer sold,  $x$  is the number of computers sold in the week and  $\$c$  is the fixed weekly cost of running the shop.

If he sells ten computers in a week his total profit is \$360.

If he only sells five computers in the week he makes a loss of \$190.

$$(10, 360) \\ (5, -190).$$

(a) Calculate  $m$  and  $c$ .

$$m = \frac{\Delta Y}{\Delta x} = \frac{360 - (-190)}{10 - 5} \\ = \frac{550}{5} \\ \underline{m = 110}$$

✓

$$\text{Profit} = 110x - c \\ \text{at } (10, 360)$$

$$360 = 110(10) - c$$

$$\therefore c = 1100 - 360$$

$$\underline{\underline{c = 740}} \quad \checkmark$$

(b) What is the least number of computers he can sell and still make a profit?

$$P = 110x - 740$$

$$0 = 110x - 740$$

$$740 = 110x$$

$$x = \frac{740}{110}$$

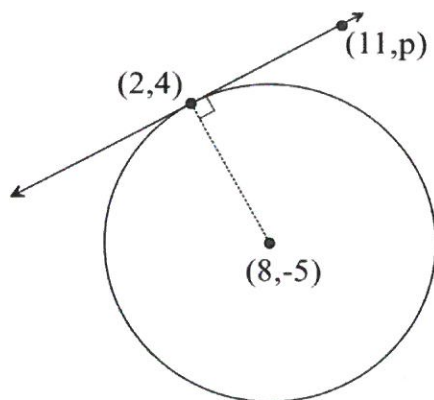
$$= 6.73$$

$$\therefore \underline{\underline{7 \text{ computers}}} \quad \checkmark$$

Question 11

(2, 2, 3 - 7 marks)

Shown below is a circle and a tangent line at the point (2,4)



(a) Determine the length of the radius of the circle, accurate to 3 significant figures.

$$\begin{aligned} r &= \sqrt{(8-2)^2 + (-5-4)^2} \checkmark \\ &= \sqrt{6^2 + (-9)^2} \\ &= \sqrt{117} \\ &= 10.8 \checkmark \end{aligned}$$

(b) Find the equation of the radius line.

$$m = -\frac{9}{6} = -\frac{3}{2}$$

$$y = -\frac{3}{2}x + c \text{ at } (2, 4).$$

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

$$c = 7 \checkmark$$

$$\boxed{y = -\frac{3}{2}x + 7} \checkmark$$

(c) Find the value of p, where the point (11, p) is a point on the tangent line.

perpendicular so  $m = \frac{2}{3}$   $\checkmark$  at (2, 4).

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

$$\begin{aligned} c &= 4 - \frac{4}{3} \\ &= \frac{8}{3} \checkmark \end{aligned}$$

Equation  $y = \frac{2}{3}x + \frac{8}{3}$  at (11, p)

$$x = 11$$

$$y = \frac{2}{3}(11) + \frac{8}{3}$$

$$\begin{aligned} y &= 10 \\ p &= 10 \checkmark \end{aligned}$$

End of Test