

# COMMONWEALTH OF AUSTRALIA

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Family Name	
Given Names	
Student Number	
Teaching Period	Semester 1, 2016

<b>FINAL EXAMINATION</b>	<b>DURATION</b>
<b>TEP024 – Advanced Foundation Maths</b>	Reading Time: <b>10</b> minutes
	Writing Time: <b>180</b> minutes

**INSTRUCTIONS TO CANDIDATES**

- 1.1 All questions are to be answered in the examination booklet provided
- 1.2 Read ALL questions carefully and attempt to answer all 14 questions.
- 1.3 Full working on all questions must be shown.
- 1.4 The maximum mark that can be obtained on the exam is 100 Marks.

**EXAM CONDITIONS**

**You may begin writing from the commencement of the examination session.** The reading time indicated above is provided as a guide only.

This is a RESTRICTED OPEN BOOK examination

Any calculator is permitted

One A4 sheet of handwritten double-sided notes permitted

Any hard copy, unannotated English dictionary is permitted

<b>ADDITIONAL AUTHORISED MATERIALS</b>	<b>EXAMINATION MATERIALS TO BE SUPPLIED</b>
No additional printed material is permitted	2 x Scrap Paper

**THIS EXAMINATION IS PRINTED  
DOUBLE-SIDED.**

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**Question 1.****[8 Marks]**

- (a) Simplify and rewrite the following algebraic expression using positive indices only.

[3]

$$\frac{(4x^3)^4}{x^5 y^5} \div \frac{(-4x^3)^2}{y^3}$$

- (b) Solve for the unknown pro numeral  $a$  in the following algebraic equation.

[3]

$$\frac{6(a-5)}{4} = -(a+8)$$

(c) Two points with coordinates  $(-6, 1)$  and  $(-3, -14)$  are joined to form a straight line.

(i) Determine the gradient of this line. [1]

(ii) Calculate the value of the y intercept and hence write the equation of the line. [1]

**Question 2.****[4 Marks]**

(a) Transpose the formulae  $F = \frac{GMm}{r^2}$  to make  $M$  the subject of the formulae. [2]

(b) Use your formulae to calculate  $M$  which is the mass of the earth given  
 $G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$ ,  $F = 7.06 \times 10^2 \text{ N}$ ,  $r = 6.38 \times 10^6 \text{ m}$ ,  $m = 72 \text{ kg}$ .  
Give your answer in scientific notation correct to 3 significant figures. [2]

**Question 3.****[4 Marks]**

Solve the following system of linear equations for  $x$  and  $y$  algebraically giving your answers as rational fractions. (Use the Elimination method for both  $x$  and  $y$ ).

$$6x - 7y = 5$$

$$-5x - 3y = -2$$

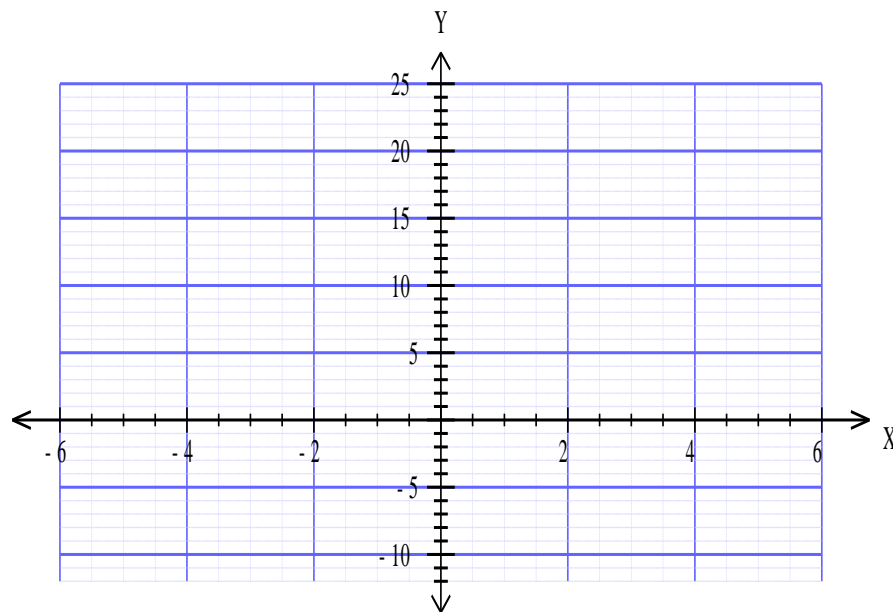
**Question 4.****[11 Marks]**

(a) Given the function  $f(x) = (3 - x)(x + 5)$ , expand the expression and hence rewrite in expanded quadratic form. [2]

(b) (i) State the coordinates of the X and Y intercepts of the function. [3]

(ii) State the coordinates of the turning point of the function. [1]

(c) Sketch the function on the axes given below **labelling** all axis intercepts (X and Y intercepts) with their **coordinates**, and **label** the turning point with its **coordinates**. [2]



(d) Find by any means possible (algebraically or otherwise) the solution for  $f(x) = (3 - x)(x + 5) = 7$ . Plot the points representing the solution/s on the graph above labelling each point/s with its coordinates. [3]



**Question 5.****[4 Marks]**

Using the quadratic formula, solve  $2x^2 - 6x + 3 = 0$  for all values of  $x$ . Give your answer in simplest surd form. (State the values of  $a$ ,  $b$  and  $c$  before you attempt to use the quadratic formula.)

**Question 6.****[2 Marks]**

Solve the following equation for  $x$  without the use of logarithms.

$$3^{2x+1} = \frac{1}{81}$$

**Question 7.****[6 Marks]**

(a) Rewrite  $5\log 2 - \log 5 + 1$  as a single logarithm.

[2]

(b) Simplify  $\frac{6 \log x}{\log x^2}$  without the use of a calculator.

[2]

(c)  $\log 5 + 3\log x^2 - 2\log x$

[2]

**Question 8.****[5 Marks]**

Solve the following equation below for  $t$  using **natural** log laws (correct to 3 significant figures).

(a)  $4e^{0.36t} = 100$  [2]

Solve the following equation below for  $t$  using log laws (correct to 3 significant figures).

(b)  $2^{t-2} = 5^{1-t}$  [3]

**Question 9.****[6 Marks]**

Two towns on the earth's equator are separated by  $2.75^\circ$  in longitude

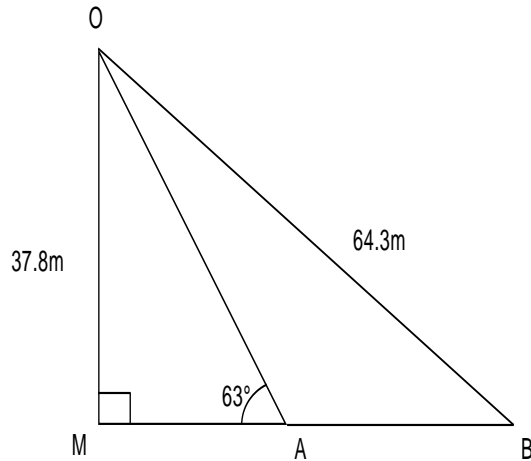
- (a) Convert  $2.75^\circ$  to radians and give your answer in terms of  $\pi$  and correct to 4 significant figures [2]
- (b) Given the earth's radius is  $6.38 \times 10^6 \text{ m}$ , calculate the distance between the two towns to the nearest kilometre? [2]
- (c) Determine the average speed (in km/h) of a vehicle which traverses the distance between the two towns in 3 hours and 15 minutes. [2]

**Question 10.****[6 Marks]**

A vertical mobile phone tower OM has a height of 37.8 m. A stainless steel supporting cable OA makes an angle of  $63^\circ$  with the ground. A second cable OB is 64.3 m in length.

Give all answers correct to 3 significant figures.

- (a) Use your knowledge of **right angle trigonometry** to find the length of the cable OA. [2]



- (b) Demonstrate your knowledge of **non right angle trigonometry** (cosine or sine rules) to find the angle between the ground and the second cable ( $\angle ABO$ ), and the distance AB, between the two cables on the ground. [4]

**Question 11.****[8 Marks]**

(a) If  $\cos\beta = -0.4789$  and  $0^\circ \leq \beta \leq 360^\circ$  find  $\beta$ . [3]

(b) Use your knowledge of the laws of natural logarithms to solve  $120e^{-0.26t} = 7(1.09)^t$   
(Give answer correct to 4 significant figures). [5]

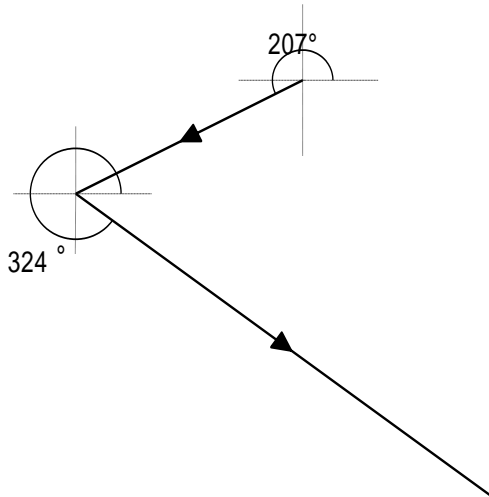
**Question 12.**

**[10 marks]**

- (a) Two velocity vectors  $33.5ms^{-1} 207^\circ$  and  $68.0ms^{-1} 324^\circ$  in the Cartesian co-ordinate system are added. Complete the diagram below which is to scale, and hence determine the magnitude and direction of the resultant velocity by measurement.

SCALE:  $1cm : 10ms^{-1}$ .

[3]

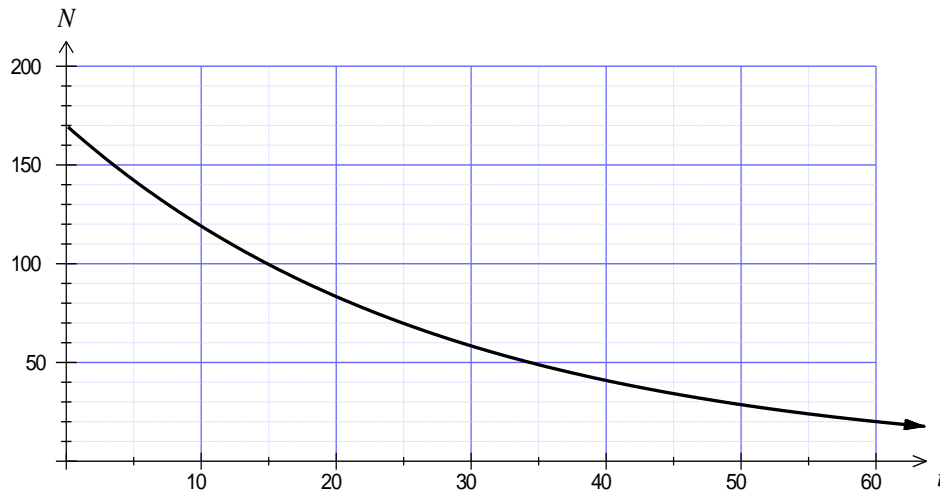


- (b) Use your knowledge of **non right angle trigonometry** to verify your answer in part (a) above (correct to 3 significant figures).

[7]

**Question 13.****[16 Marks]**

Drawn below is the graph of the function  $N(t) = 170(0.965)^t$  where  $N$  represents the number of termites in a laboratory termite mound over time,  $t$ , in weeks. These termites are given little food and poor living conditions.

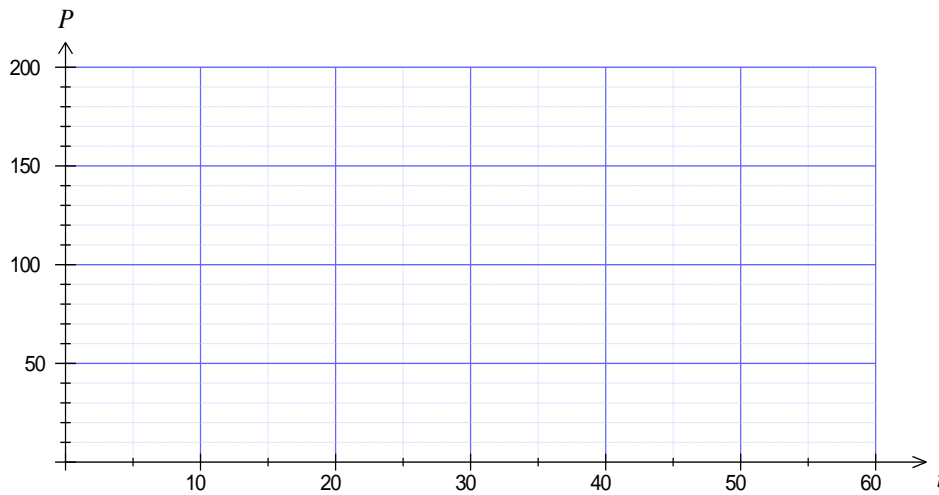


- (a) (i) Calculate the initial value of  $N$ , ie  $N(0)$ . [1]
- (ii) Plot this point on your graph labelling the point with its coordinates. [1]
- (b) (i) Calculate the number of termites after one year. [1]
- (ii) Plot this point on the graph labelling it with its coordinates. [1]
- (c) Determine algebraically how many weeks it will take for the number of termites in the mound to decrease to 25% of the original number. [4]



this question is continued on the next page.

- (d) Another mound of termites in the same laboratory is given choice slivers of bark and wood to eat, and ideal living conditions. Their numbers are found to increase over time ( $t$ , in weeks) according to the model  $P(t) = 50(1.026)^t$ . Plot the graph for this model on the axes given below. Show at least 3 points along the curve labelling each point with its coordinates. [4]



- (e) At some point in time the number of termites in both colonies will be equal.

Determine when that will be to the nearest whole week and how many termites there will be in each colony at that time.

ie Solve  $170(0.965)^t = 50(1.026)^t$  [4]

**Question 14.****[10 Marks]**

- (a) Two force vectors  $P = 51N$   $189^\circ$  and  $Q = 82N$   $70^\circ$  in the Cartesian coordinate system are added. Draw an accurate scale diagram so that you can measure the magnitude and direction of the addition of these two vectors. [3]

this question is continued on the next page.

- (b) Add the two vectors by finding their horizontal and vertical components and hence calculate the magnitude and direction of the resultant vector. (Work correct to 3 decimal places and give final answer correct to the nearest whole Newton ( $N$ ) and whole degree ( $^\circ$ )). [7]

		$R_x$	$R_y$
<b>A</b>	$P = 51N\ 189^\circ$		
<b>B</b>	$Q = 82N\ 70^\circ$		

MAGNITUDE

DIRECTION

RESULTANT