

# Science and Engineering Foundation Programme

## Assessment 1

### SEF041& MED3001 - Mathematics B

Tuesday 5 November 2019, 11.00am

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**Time Allowed:** 50 minutes

**Note:**

The mark will be calculated from **the best ANSWERS to FOUR** questions out of **FIVE**.

All questions carry equal marks.

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**FULL NAME:**

**STUDENT ID:**

**TUTOR GROUP:**

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**Instructions:**

**DO NOT TURN OVER THE SCRIPT** until the test has started.

Make sure you read all questions carefully.

**CALCULATORS:**

Only Casio fx-82, fx-83 and fx-85 are allowed (+ extensions like ES, GT, GT plus).

For marking purposes only:

Question	Marks	Comments
1		
2		
3		
4		
5		
<b>TOTAL :</b>		



1. (a) Rewrite as a power of  $a$ :

$$\sqrt[3]{a}.$$

[2]

(b) Simplify as far as possible:

$$\frac{\sqrt[3]{a^7} \sqrt{a}}{a^{-4}}.$$

[8]

(c) Change to base 2 and simplify as far as possible:

$$\log_4 \sqrt{x}.$$

[5]

(d) Solve for  $x$

$$1 + \log_2(x^2) + \log_4 \sqrt{x} = 4.$$

Give your solution in its simplest surd (exact) form.

[10]

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**Write your solutions here**

**Write your solutions here**

2. (a) The quadratic is specified as

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

- i) Find values of  $k$  for which the equation  $f(x) = 0$  has a repeated root. [5]
  - ii) For  $k = 3$  write  $f(x)$  in a factorised form. [5]
  - iii) For  $k = 2$  what is the minimum value of  $f(x)$  and what is its symmetry axis. [8]
- (b) When the polynomial  $g(x) = x^3 + x^2 - px - 2$  is divided by  $x - 3$ , the remainder is 1. Find the value of the constant  $p$ . [7]

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**Write your solutions here**

**Write your solutions here**

3. Consider the three points  $A = (0, -1)$ ,  $B = (2, 3)$  and  $C = (5, 1)$ .

(a) Find the equation of the line segment  $AB$  in an implicit form. [5]

(b) Find the shortest distance of point  $C$  from the line  $y = 2x - 1$ . [5]

(c) Find the equation of the perpendicular bisector of the line segment  $AB$ . [15]

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**Write your solutions here**

**Write your solutions here**



4. (a) Consider the following equation of a circle:

$$(x - 1)^2 + \left(y - \frac{2}{3}\right)^2 = \frac{4}{9}$$

- i) Specify the coordinates of the centre. [2]
  - ii) Specify the radius. [2]
  - iii) Write it in a parametric form. [6]
- (b) Let  $A = (1, 2)$  and  $B = (1, 1)$ . Derive an equation specifying the locus of all points  $P = (x, y)$  such that the distance  $\overline{AP}$  is 2 times as long as the distance  $\overline{BP}$ . Clearly specify which curve you obtained. [15]

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**Write your solutions here**

**Write your solutions here**

5. Function  $g(x)$  is specified as

$$g(x) = x^2 - 3.$$

- (a) Specify the (largest valid) domain and image for  $g(x)$ . [2]
- (b) What is the domain and range so that  $g(x)$  becomes invertible? [3]
- (c) Find the inverse function  $g^{-1}(x)$  and specify the domain and range of the inverse function. [5]
- (d) Specify if function  $g(x)$  is odd, even or neither. Show all your working. [7]
- (e) Compose  $g(x)$  with  $f(x) = e^x$ , i.e. find:  $(f \circ g)(x) = f(g(x))$  and  $(g \circ f)(x) = g(f(x))$ . [8]

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**Write your solutions here**

**Write your solutions here**