

MOCK EXAM 2015/16

TERM 1

NAME OF COURSE/PROGRAMME:

BEng Foundation Year

YEAR OR LEVEL:

Year 0

NAME OF MODULE/UNIT/EXAM PAPER:

Mathematics Test 1

**DATE OF EXAMINATION: 7th/8th December
2015**

EXAMINATION TIMES:

TIME ALLOWED: 2 hours

INSTRUCTIONS TO CANDIDATES:

Attempt ALL questions.

Closed book test.

Calculators allowed.

QUESTION ONE

a) Convert the following improper fractions into mixed fractions:

(i) $\frac{9}{7}$ (ii) $\frac{15}{4}$ (iii) $\frac{26}{7}$

b) Calculate the following, showing your workings, and showing your answer as a mixed fraction:

(i) $7\frac{3}{4} \times 3\frac{1}{5}$ (ii) $11\frac{2}{3} - 3\frac{2}{5}$ (10 marks)

QUESTION TWO

Express the following number to 6 decimal places and 2 significant figures:

7.4623826 (2 marks)

QUESTION THREE

Express 0.000523 in standard form.

(1 mark)

QUESTION FOUR

Simplify the following:

(i) $x^5 \times x^6$

(ii) $(3z^2)^3$

(iii) $\frac{x^4 \times x^2}{x^3}$

(iv) $\sqrt{\frac{1}{x}}$

(v) $\sqrt[3]{x^2 \times x^3}$

(9 marks)

QUESTION FIVE

Factorise the following completely:

(i) $6x^2y + 3y$

(iv) $x^2 + 3x - 10$

(ii) $2x^4y + 6x^3y^2 + 2x^4y^2$

(v) $a^2 - 4$

(iii) $x^2 + 8x + 16$

(vi) $2x^2 + 7x + 6$

(15 marks)

QUESTION SIX

Solve the following linear equations for x :

a) $\frac{6}{x-1} = \frac{2}{x+4}$

b) $(x+3)^2 = x^2 - 6$

c) $(x+5)(x-1) = (x+3)(x+2)$

(16 marks)

QUESTION SEVEN

Evaluate the following when $x = -2, y = 4, z = -1$:

$$\frac{x^3 + yz^2}{z}$$

(3 marks)

QUESTION EIGHT

Solve the following quadratic equations by factorising:

a) $x^2 + x - 6 = 0$

b) $x^2 - 49 = 0$

c) $3x^2 + 8x + 4 = 0$

(11 marks)

QUESTION NINE

Solve the following quadratic equation by using the quadratic formula:

$$10x^2 + 7x - 4 = 0$$

(6 marks)

QUESTION TEN

Solve the following system of simultaneous linear equations:

$$3x + 5y = 7$$

$$4x + 7y = 10$$

(5 marks)

QUESTION ELEVEN

Solve the following by using the laws of logarithms:

(i) $4^{x+1} = 3 \times 2^x$

(ii) $2 \log(x + 4) = \log(x + 1) + \log(x + 2)$

(8 marks)

Q1)

a) (i) $1\frac{2}{7}$ (ii) $3\frac{3}{4}$ (iii) $3\frac{5}{7}$

b) (i) $7\frac{3}{4} \times 3\frac{1}{5}$

$$= \frac{31}{4} \times \frac{16}{5}$$

$$= \frac{124}{5}$$

$$= 24\frac{4}{5}$$

(ii) $11\frac{2}{3} - 3\frac{2}{5}$

$$= \frac{35}{3} - \frac{17}{5}$$

$$= \frac{124}{15}$$

$$= 8\frac{4}{15}$$

Q2) $0.462383 \rightarrow 7.462383$

2sf $\rightarrow 7.5$

Q3) 5.23×10^{-4}

Q4)

$$(i) = x^{11}$$

$$(ii) = 27x^6$$

$$(iii) = x^3$$

$$(iv) = \sqrt{x^{-1}} = (x^{-1})^{1/2} \\ = x^{-1/2}$$

$$(v) = \sqrt[3]{x^5} = x^{5/3}$$

$$Q5) (i) 3y(2x^2 + 1)$$

$$(v) (a+2)(a-2)$$

$$(ii) 2x^3y(x + 3y + xy)$$

$$(vi) (2x+3)(x+2)$$

$$(iii) (x+4)(x+4) \text{ i.e. } (x+4)^2$$

$$(iv) (x+5)(x-2)$$

Q6

$$a) \frac{6}{x-1} = \frac{2}{x+4}$$

$$6(x+4) = 2(x-1)$$

$$6x + 24 = 2x - 2$$

$$6x - 2x = -2 - 24$$

$$4x = -26$$

$$x = \frac{-26}{4} = \underline{\underline{-6.5}}$$

$$b) (x+3)^2 = x^2 - 6$$

$$x^2 + 6x + 9 = x^2 - 6$$

$$6x = -6 - 9$$

$$6x = -15$$

$$x = \frac{-15}{6}$$

$$c) (x+5)(x-1) = (x+3)(x+2)$$

$$x^2 + 4x - 5 = x^2 + 5x + 6$$

$$4x - 5 = 5x + 6$$

$$-6 - 5 = 5x - 4x$$

$$\underline{\underline{-11 = x}}$$

Q7) $x = -2, y = 4, z = -1$

$$= \frac{(-2)^3 + (4)(-1)^2}{(-1)}$$

$$= \frac{-8 + (4)(1)}{-1}$$

$$= \frac{-8 + 4}{-1}$$

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

$$= 4$$

Q8)

a) $(x+3)(x-2) = 0$

$$x = -3 \quad x = 2$$

c) $(3x+2)(x+2) = 0$

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

b) $(x+7)(x-7) = 0$

$$x = -7 \quad x = 7$$

Q9)

$$10x^2 + 7x - 4 = 0$$

$$a = 10$$

$$\uparrow$$

a

$$\uparrow$$

b

$$\uparrow$$

c

$$b = 7$$

$$c = -4$$

$$x = \frac{-7 \pm \sqrt{(7)^2 - 4(10)(-4)}}{2(10)}$$

$$x = \frac{-7 \pm \sqrt{49 + 160}}{20}$$

$$x = \frac{-7 \pm 14.46}{20}$$

$$x = 0.37$$

$$x = -1.07$$

Q10)

$$3x + 5y = 7 \quad (1) \times 4$$

$$4x + 7y = 10 \quad (2) \times 3$$

$$12x + 20y = 28 \quad (3)$$

$$12x + 21y = 30 \quad (4)$$

$$(4) - (3)$$

$$(y = 2) \rightarrow \text{in } (1)$$

$$3x + 10 = 7$$

$$3x = -3$$

$$x = -1$$

Q11)

$$(i) \quad 4^{x+1} = 3 \times 2^x$$

$$\therefore \log 4^{x+1} = \log 3 \times 2^x$$

$$(x+1) \log 4 = \log 3 + x \log 2$$

$$0.60x + 0.60 = 0.48 + 0.30x$$

$$0.60x - 0.30x = 0.48 - 0.60$$

$$0.30x = -0.12$$

$$x = -0.40$$

$$(ii) \quad 2 \log(x+4) = \log(x+1) + \log(x+2)$$

$$\log(x+4)^2 = \log(x+1)(x+2)$$

$$(x+4)(x+4) = (x+1)(x+2)$$

$$x^2 + 8x + 16 = x^2 + 3x + 2$$

$$8x - 3x = 2 - 16$$

$$5x = -14$$

$$x = \frac{-14}{5}$$

$$= -2.8$$