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LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
JANUARY 2022

MODULE CODE: ACHA4000
ANALYTICAL METHODS

TIME: 1 ½ HOURS

(PLUS HALF AN HOUR TO SUBMIT SOLUTIONS – 2 HOURS IN TOTAL)

ANSWER ALL QUESTIONS

Equipment or materials required –

Calculators allowed

Formula booklet provided

SHOW ALL WORKINGS

IMPORTANT INSTRUCTIONS FOR ONLINE EXAMINATIONS:

- *You will need to submit a digital photograph or scan of each page of workings, preferably all in one Word document*
- *Please submit these to Moodle (underneath where you accessed the exam paper)*
- *Put the time, date, module code and your student number at the top of each page*
- *Number each page ‘x of y’*
- *If you have any issues, email richard.sutton@uwtsd.ac.uk*

QUESTION ONE

a) Solve the following equations, using the appropriate method, for x :

(i) $\frac{3x-1}{5} = \frac{6x+5}{9}$

(ii) $1 + \frac{5}{x} = \frac{-6}{x^2}$

(iii) $2 \log(3x + 1) = \log(x + 3) + \log(x + 7)$

.(12 marks)

b) Factorise the following algebraic expressions **completely**:

(i) $8P^3Q^2 - 4P^2Q^3 + 2P^3Q$

(ii) $x^2 - y^2$

(6 marks)

c) Solve the following quadratic equations **by using the factorisation method**:

(i) $x^2 + 12x + 20 = 0$

(ii) $2x^2 + x - 15 = 0$

(iii) $x^2 - 400 = 0$

(10 marks)

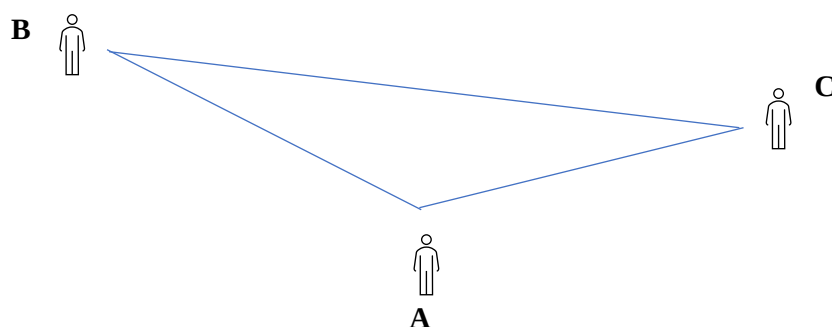
QUESTION TWO

The following people are testing some distance measuring apparatus. If the angle at point A is 70° , the angle at point B is 32° and the distance between person A and C is 35 metres, calculate:

(i) The angle at C

(ii) The distance between person A and person B

(iii) The distance between person B and person C



Triangle not drawn to scale.

(6 marks)

QUESTION THREE

a) Solve the following trigonometric equations for $0^\circ \leq x \leq 360^\circ$:

(i) $\sin x = 0.67$

(ii) $\tan^2 x - 7 \tan x + 10 = 0$

(8 marks)

QUESTION FOUR

Solve the following system of simultaneous equations for x and y :

$$y = 5x^2 + 12x - 14$$

$$y = 4x^2 + 3x - 4$$

(7 marks)

QUESTION FIVE

a) Given the following complex numbers, $z_1 = 3 + 7j$, $z_2 = 2 - 10j$, calculate the following, **expressing your answers in rectangular form**:

(i) $z_1 + z_2$ (ii) $z_1 - \bar{z}_2$ (iii) $\frac{z_1}{z_2}$

(7 marks)

b) Solve the following quadratic equation, **expressing your answers in Polar Form**:

$$7x^2 = -2x - 11$$

(10 marks)

c) Use de Moivre's' theorem to calculate the following, **expressing your answer in rectangular form**:

(i) $(5 + 3j)^4$

(7 marks)

QUESTION SIX

a) Find the first derivative of the following functions:

(i) $y = 9x^3 + 7x^2 - x + 4$

(ii) $y = (2x + 3)(3x - 5)$

(iii) $y = 2 \ln x + \frac{5}{x}$

(iv) $y = 7 \sin x + 3 \cos 2x + \tan \frac{x}{2}$

(v) $y = x^5 \sin 2x$

(vi) $y = \frac{e^{3x}}{x^3}$

(vii) $y = (5x^2 - 2x + 1)^5$

(24 marks)

QUESTION SEVEN

a) Integrate the following:

(i) $\int x^5 + 2x^2 + x - 10 \, dx$

(ii) $\int (2x + 5)(x^2 - 1) \, dx$

(iii) $\int_2^5 2x^2(x^2 + 3) \, dx$

(iv) $\int 5 \sin 3x - \cos \frac{x}{3} \, dx$

(20 marks)

TOTAL MARKS: 117

End of paper.