



MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN MECHANICAL ENGINEERING (TVET)

ENGINEERING MATHEMATICS II

DATE: 24/3/2020

TIME: 8.30-11.30 AM

INSTRUCTIONS:

This paper consists of five questions, attempt ALL.

QUESTION ONE

- a) The area of a metal plate is 426 mm^2 . If its length is 47.6 mm find its width in mm (to 3 significant figures) (4 marks)
- b) A rectangular fish tank measure 42.0 cm by 36.3 cm by 4.20 m . Find its volume in m^3 (4 marks)
- c) A block of copper weighing 30kg is drawn out to make 400m of wire of uniform circular cross-section. Given that cm^3 of copper weighs 8.91g calculate:
- The volume of the copper in cm^3 (4 marks)
 - The area of the cross-section of the wire in cm^2 (4 marks)
 - The radius of the cross-section of the wire in mm (4 marks)

QUESTION TWO

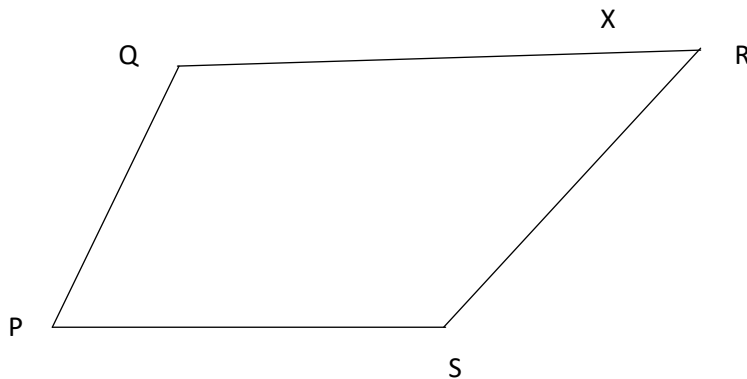
- a) Find the magnitude and direction of the vector $\vec{V} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$ (4 marks)

- b) Solve for x and y given that;

$$x \begin{bmatrix} 2 \\ 3 \end{bmatrix} + y \begin{bmatrix} 2 \\ 1 \end{bmatrix} = \begin{bmatrix} 8 \\ 6 \end{bmatrix} \quad (4 \text{ marks})$$

- c) Compute $2v + 3w$ if $v = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$ and $w = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ (5 marks)

- d) PQRS is a trapezium. PS is parallel to QR. $QR = 2PS$, $PQ = \mathbf{a}$ and $PS = \mathbf{b}$. **X** is the point on QR such that $QX:XR=3:1$.



Express in terms of $\mathbf{a}$ and $\mathbf{b}$ (7 marks)

- i. $\mathbf{PR}$
- ii. $\mathbf{SX}$

QUESTION THREE

- a) Define probability (2 marks)
- b) A bag contains 3 red balls, 7 black balls and 10 white balls, determine the probability of drawing; (7 marks)
- i. red ball
 - ii. black ball
 - iii. white ball
- c) if the probability of winning a prize is $\frac{1}{50}$ and the prize is £100, determine the expectation. (3 marks)
- d) Two balls are drawn in turn with replacement from a bag containing 8 red balls, 15 white balls, 24 black balls and 17 orange balls. Determine the probability of having; (8 marks)

- i. Two red balls
- ii. A red and a white ball
- iii. No orange balls
- iv. A black and red or a black and orange ball

QUESTION FOUR

- a) Find $\frac{dy}{dx}$, given that; (4 marks)
- $$y = (4x^3 - 3x + 2)(2x^2 + 4x)$$
- b) Differentiate y with respect to x given that; (5 marks)
- $$y = \frac{x^3}{1-x^2}$$
- c) Find the derivative of $y = \sqrt{x}$ from the first principles (6 marks)
- d) Determine the fourth derivative of $f(x)$ given that; (8 marks)
- $$f(x) = 2x^4 - 4x^3 + 7x^2 - 2x + 8$$

QUESTION FIVE

- a) Find, $\int (3x^2 + 4x) dx$ (3marks)
- b) Solve the differential equation
- $$\frac{dy}{dx} = \frac{x + 3x^2}{y^2}$$
- Then find the solution for $y = 6$ when $x = 0$ (7 marks)
- c) Evaluate: (10 marks)
- i. $\int_0^4 (2x^2 + 5x - 2) dx$
 - ii. $\int_3^5 \frac{4}{x} dx$
 - iii. $\int_0^2 \frac{7}{5x+4} dx$