2024 SEED MSCE MOCK
PROVISIONAL MARKING KEY
MATHEMATICS I

SOUTH EAST EDUCATION DIVISION

2024 MALAWI SCHOOL CERTIFICATE OF EDUACTION MOCK EXAMINATION

MATHEMATICS

PAPER I

1. Factorise completely $2x^2 + 4xy - 30y^2$ **(3 marks)**

$= 2(x^2 + 2xy - 15y^2)$ *(1)*

$= 2[(x^2 - 3xy) + (5xy - 15y^2)]$

$= 2[x(x - 3y) + 5y(x - 3y)]$ *(1)*

$= 2[(x + 5y)(x - 3y))]$ *(1)*

2. Evaluate $\log_2[\log_3(\log_5 125)]$ **(4 marks)**

$= \log_2[\log_3(\log_5 5^3)]$ *(1)*

$= \log_2[\log_3(3\log_5 5)]$

$= \log_2[\log_3(3x1)]$ *(1)*

$= \log_2[\log_3 3]$ *(1)*

$= \log_2 1$

$= 0$ *(1)*

3. **Figure 1** is a triangle ABC in which angle BAC = 60°, AC = 10cm and the area of the triangle is $5\sqrt{6}\ cm^2$.

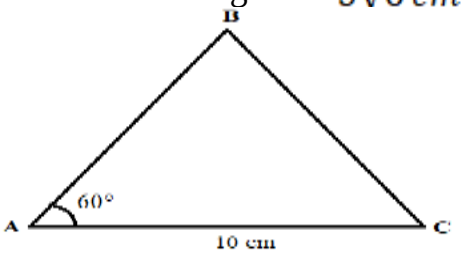


Figure 1

Calculate the length of AB leaving the answer in its simplest surd form. **(6 marks)**

$Area\ of\ \Delta ABC = \frac{1}{2}ABxACSin60°$ *(1)*

$\frac{5\sqrt{6}}{1} = \frac{1}{2}ABx10Sin60°$ *(1)*

$\frac{5\sqrt{6}}{5} = \frac{5ABSin60°}{5}$

$\sqrt{6} = AB\ x\frac{\sqrt{3}}{2}$ *(1)*

$AB = \frac{2\sqrt{6}}{\sqrt{3}}$

$= \frac{2\sqrt{6}}{\sqrt{3}}\ x\ \frac{\sqrt{3}}{\sqrt{3}}$ *(1)*

$= \frac{2\sqrt{18}}{3}$

$= \frac{2 \times 3\sqrt{2}}{3}$ *(1)*

$= 2\sqrt{2}$ *(1)*

4. Simplify $\frac{2}{\sqrt{3}} - \frac{\sqrt{3}}{2}$ **(4 marks)**

$= \frac{4-\sqrt{9}}{2\sqrt{3}}$ *(1)*

$= \frac{4-3}{2\sqrt{3}}$

$= \frac{1}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ *(1)*

$= \frac{\sqrt{3}}{2x3}$ *(1)*

$= \frac{\sqrt{3}}{6}$ *(1)*

5. Triangle ABC has vertices A (–1, 2), B (3, 3) and C (2, –1).

Show that angle BAC = angle ACB. **(5 marks)**

$|AB| = \sqrt{(3--1)^2 + (3-2)^2}$ *(1)*

$= \sqrt{(4)^2 + (1)^2}$

$= \sqrt{16+1}$

$= \sqrt{17}$ *(1)*

$|BC| = \sqrt{(2-3)^2 + (-1-3)^2}$ *(1)*

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

$= \sqrt{1+16}$

$= \sqrt{17}$ *(1)*

Since length AB = BC

∴ Angle BAC = Angle ACB *(1)*

6. Simplify $\frac{e^2 - 5e + 6}{e^2 + 2e - 3} \div \frac{3e-9}{2e^2+6e}$. **(5 marks)**

$= \frac{e^2 - 5e + 6}{e^2 + 2e - 3} \times \frac{2e^2 + 6e}{3e - 9}$ *(1)*

$= \frac{(e-2)(e-3)}{(e-1)(e+3)} \times \frac{2e(e+3)}{3(e-3)}$ *(3)*

$= \frac{2e(e-2)}{3(e-1)}$ *(1)*

7. Given that T and R are two matrices. If $T = \begin{bmatrix} 2 & 1 \\ -1 & 3 \end{bmatrix}$ and $R = \begin{bmatrix} 0 & 3 \\ -1 & 1 \end{bmatrix}$, find $3R - T^2$. **(5 marks)**

$= 3\begin{bmatrix} 0 & 3 \\ -1 & 1 \end{bmatrix} - \begin{bmatrix} 2 & 1 \\ -1 & 3 \end{bmatrix}\begin{bmatrix} 2 & 1 \\ -1 & 3 \end{bmatrix}$ *(1)*

$= \begin{bmatrix} 0 & 9 \\ -3 & 3 \end{bmatrix} - \begin{bmatrix} 2x2 + 1x - 1 & 2x1 + 1x3 \\ -1x2 + 3x - 1 & -1x1 + 3x3 \end{bmatrix}$ *(2)*

$= \begin{bmatrix} 0 & 9 \\ -9 & 3 \end{bmatrix} - \begin{bmatrix} 3 & 5 \\ -5 & 8 \end{bmatrix}$ *(1)*

$= \begin{bmatrix} -3 & 4 \\ 5 & -5 \end{bmatrix}$ *(1)*

8. Given that $\underline{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$, $\underline{b} = \begin{pmatrix} 10 \\ 15 \end{pmatrix}$ and $\underline{c} = \begin{pmatrix} 1 \\ 8 \end{pmatrix}$, find $\left| \underline{c} + \underline{a} - \frac{1}{5}\underline{b} \right|$ leaving your answer to 2 decimal places. **(6 marks)**

$\begin{pmatrix} 1 \\ 8 \end{pmatrix} + \begin{pmatrix} 4 \\ 3 \end{pmatrix} - \frac{1}{5}\begin{pmatrix} 10 \\ 15 \end{pmatrix} = \mathbf{c} + \mathbf{a} - \frac{1}{5}\mathbf{b}$ *(1)*

$\begin{pmatrix} 1 \\ 8 \end{pmatrix} + \begin{pmatrix} 4 \\ 3 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \end{pmatrix} = \mathbf{c} + \mathbf{a} - \frac{1}{5}\mathbf{b}$ *(1)*

$\begin{pmatrix} 3 \\ 8 \end{pmatrix} = \mathbf{c} + \mathbf{a} - \frac{1}{5}\mathbf{b}$ *(1)*

$\left| \mathbf{c} + \mathbf{a} - \frac{1}{5}\mathbf{b} \right| = \sqrt{3^2 + 8^2}$ *(1)*

$= \sqrt{9 + 64}$

$= \sqrt{73}$ *(1)*

$= 8.5440$

$= 8.54$ *(1)*

9. In **Figure 2**, RD and RE are tangents to a circle PDE at D and E respectively.

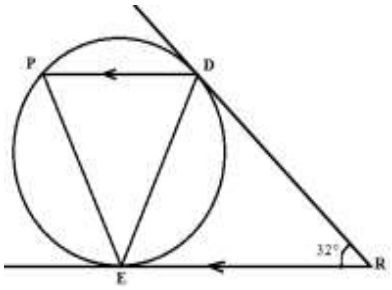


Figure 2

If angle DRE = 32°, calculate angle PED. **(5 marks)**

DR = ER, (tangents from an ext. pt. are =) *(1)*

<DER = <CDR, (base <s) *(1)*

$<DER = (180° - 32°)/2$ *(sum of <s in a Δ)* *(1)*

$= 74°$

$<PDE = 74°$, *(alt. <s)* *(1)*

$<DPE = 74°$, *(<s in alt. seg.)*

$\therefore <PED = 180° - 74° - 74°$, *(sum of <s. in Δ)*

$= 32°$ *(1)*

10. Make *x* the subject of the formula, $V = w\sqrt{a^2 - x^2}$ **(5 marks)**

$\frac{V}{w} = \frac{w\sqrt{a^2 - x^2}}{w}$ *(1)*

$(\frac{V}{w})^2 = (\sqrt{a^2 - x^2})^2$ *(1)*

$\frac{V^2}{w^2} = a^2 - x^2$ *(1)*

$x^2 = a^2 - \frac{V^2}{w^2}$ *(1)*

$x = \pm\sqrt{a^2 - \frac{V^2}{w^2}}$ *(1)*

11. Calculate the standard deviation of the following numbers $(t + 5)$, t and $(t - 5)$.

(5 marks)

$$\bar{x} = \frac{(t+5) + t + (t-5)}{3}$$

$= \frac{3t}{3}$

$= t$ *(1)*

X	$\bar{x}$	$x - \bar{x}$	$(x - \bar{x})^2$
$t + 5$	t	5	25
T	t	0	0
$t - 5$	t	-5	25
$\Sigma(x - \overline{x})^2$			50

(2)

$Variance = \frac{\Sigma(x - \overline{x})^2}{n}$

$= \frac{50}{3}$

$= 16.67$ *(1)*

$Std\ deviation = \sqrt{16.67}$

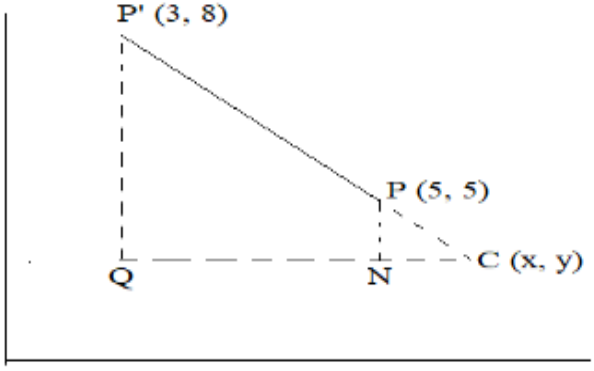
$= 4.08$ *(1)*

12. When $x^3 - 7x + t$ is divided by x – 2, the remainder is 10, find the value of *t*.

(5 marks)

$$\begin{aligned} Let\ x - 2 &= 0 \\ x &= 2 \qquad (1) \\ P(2) = (2)^2 - 7(2) + t &= 10 \qquad (1) \\ 8 - 14 + t &= 10 \qquad (1) \\ -6 + t &= 10 \qquad (1) \\ t &= 10 + 6 \\ &= 16 \qquad (1) \end{aligned}$$

13. Under an enlargement scale factor 2, the image of point *P (5, 5)* is *P′ (3, 8)*. Calculate the coordinates of the centre of enlargement. **(4 marks)**



CP'Q III CPN

$$\frac{P'Q}{PN} = \frac{P'C}{PC} = 2$$

$$\frac{8-y}{5-y} = 2$$

$$8 - y = 2(5 - y$$

$$8 - y = 10 - 2y$$

$$2y - y = 10 - 8$$

$$y = 2$$

$$\frac{QC}{NC} = \frac{P'C}{PC} = 2$$

$$\frac{x-3}{x-5} = 2$$

$$x - 3 = 2x - 10$$

$$2x - x = 10 - 3$$

$$x = 7$$

$\therefore$ *Centre of enlargement is (7, 2)*

14. z varies jointly as the square of x and inversely as the square root of y. When x = 10, y = 4 and z = 15. Find x when z = 8 and y = 25.

(5 marks)

$z \propto \frac{x^2}{\sqrt{y}}$ *(1)*

$z = \frac{kx^2}{\sqrt{y}}$, *where k is constant*

$15 = \frac{k(10)^2}{\sqrt{4}}$ *(1)*

$15 = \frac{100k}{2}$

$100k = 30$

$k = \frac{30}{100}$

$k = \frac{3}{10}$ *(1)*

The equation

$z = \frac{0.3x^2}{\sqrt{25}}$ *(1)*

$8 = \frac{0.3x^2}{5}$

$x^2 = \frac{40}{0.3}$

$x = \pm\sqrt{\frac{40}{0.3}}$

$x = \pm\sqrt{133.3}$ *(1)*

$x = \pm 11.547$

15. **Figure 3** is a straight line graph.

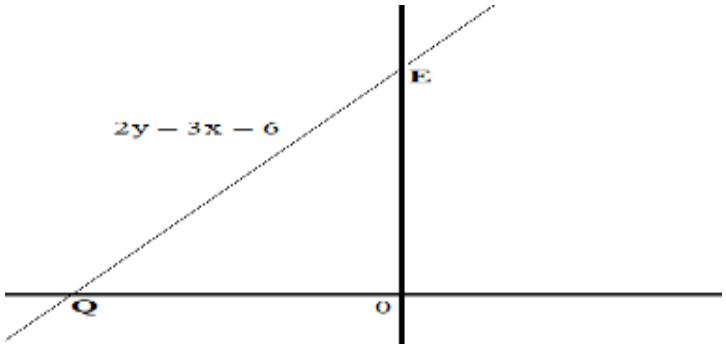


Figure 3

Calculate the length of OE. **(5 marks)**

Let x = 0

2y – 3(0) = 6

$\frac{2y}{2} = \frac{6}{2}$

y = 3 (0,3) *(1)*

let y = 0

$2(0) - 3x = 6$

$\frac{-3x}{-3} = \frac{6}{-3}$

x = −2 (−2,0) *(1)*

$= \sqrt{(0-3)^2 + (-2-0)^2}$ *(1)*

$= \sqrt{(-3)^2 + (-2)^2}$

$= \sqrt{9+4}$ *(1)*

$= \sqrt{13}$

$= 0.6056$ *(1)*

16. Without plotting the graphs, find the points of the following equations $y = x^2 - 4x + 5$ and $y + 2x = 8$. **(5 marks)**

y = 8 – 2x
y = x² – 4x + 5
8 – 2x = x² – 4x + 5 *(1)*
x² – 4x + 2x + 5 – 8 = 0
x² – 2x – 3 = 0
(x – 3)(x + 1) = 0 *(1)*
x = – 1 or 3 *(1)*
To find y when x = – 1 or 3
y = 8 – 2(-1) *or* *y = 8 – 2(3)*
y = 8 + 2 *y = 8 – 6*
y = 10 *(1)* *y = 2* *(1)*

x	***y***
– 1	*10*
3	*2*

17. **Figure 4** shows unshaded region **B** bounded by inequalities.

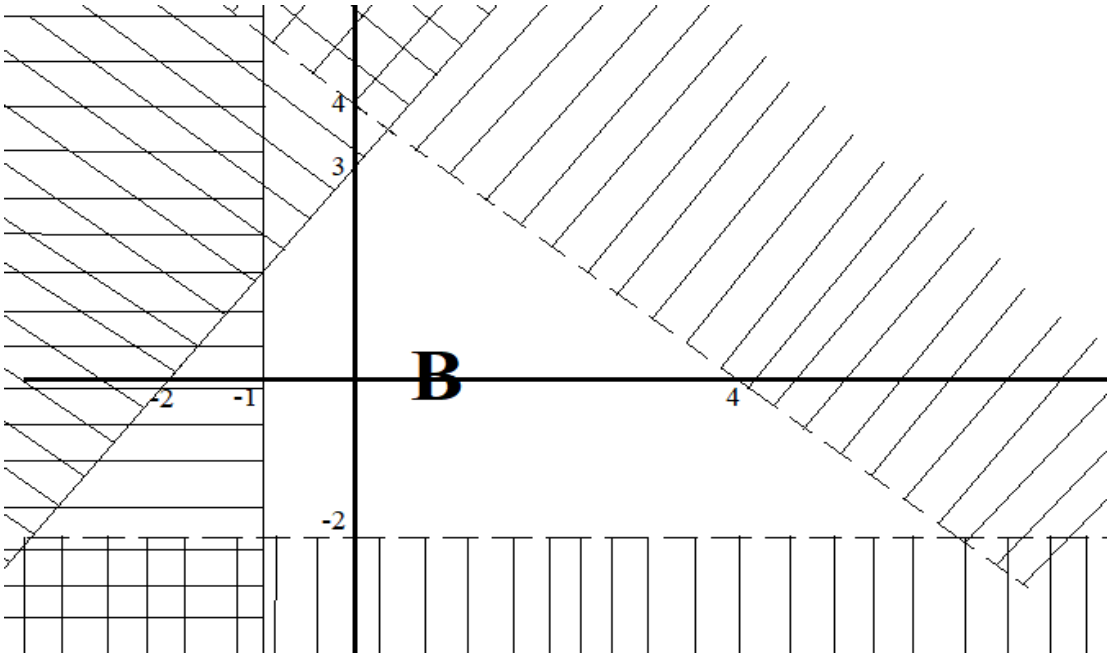


Figure 4

Write down the **three** inequalities that describe region B in addition to $x \geq -1$.

(6 marks)

$(-2,0),(0,3)$

$m = \frac{3-0}{0-(-2)}$

$= \frac{3}{2}$ (1)

$\frac{3}{2} = \frac{y-0}{x-(-2)}$

$\frac{3}{2} = \frac{y}{x+2}$

$3(x + 2) = 2y$

$3x + 6 = 2y$

$2y = 3x + 4$

$y = \frac{3x+4}{2}$

$(i).\ y \geq \frac{3x+4}{2}$ (1)

$(ii).y > -2$ (1)

(4, 0), (0, 4)

$m = \frac{4-0}{0-4}$

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

$= -1$ (1)

$y = -x + 4$

$(iii).y < 4 - x$ (1)

18. **Figure 5** is a speed – time graph.

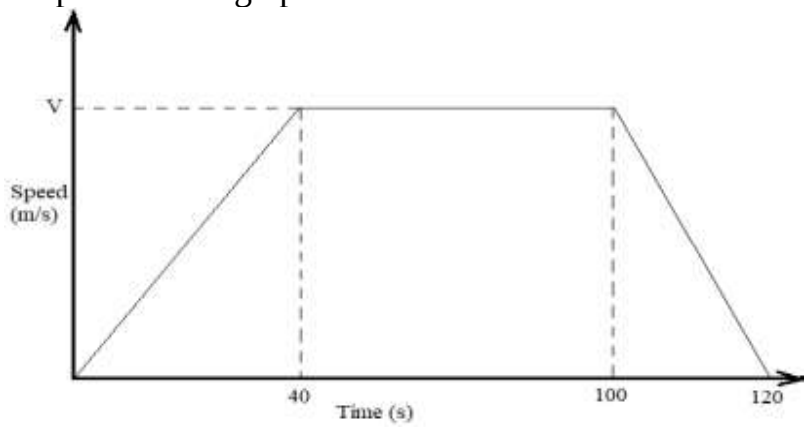


Figure 5

Given that the total distance travelled is 7200m, calculate the acceleration in the first 40 seconds. **(5 marks)**

Total distance = Area under the graph

$7200 = \frac{1}{2}(60 + 120)V$ (1)

$7200 = \frac{1}{2}x180V$

$7200 = 90V$

$V = \frac{7200}{90}$

$V = 80m/s$ (1)

$a = \frac{v-u}{t}$ (1)

$= \frac{(80-0)m/s}{40s}$ (1)

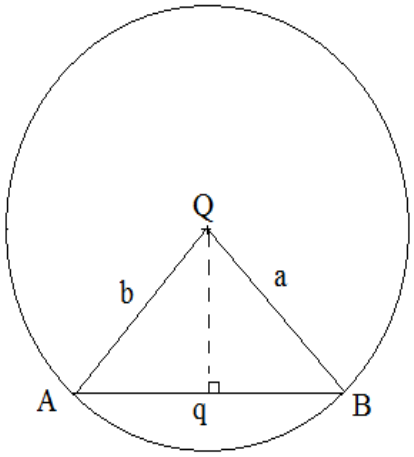
$= \frac{80m/s}{40s}$

$= 2m/s^2$ (1)

19. In a Geometric Progression (GP). the sum of the second and third terms is 9 and the seventh term is eight times the fourth term. Calculate the sum of the first 5 terms. **(6 marks)**

$ar + ar^2 = 9$
$ar^6 = 8ar^3$
$\frac{ar^6}{ar^3} = 8$
$r^3 = 8$
$r = 2$ *(1)*
$ar + ar^2 = 9$
$r = 2$
$2a + a(2)^2 = 9$
$2a + 4a = 9$
$6a = 9$
$a = \frac{3}{2}$ *(1)*
$S_n = \frac{ar^n - 1}{r - 1}$ *(1)*
$S_5 = \frac{\frac{3}{2}(2^5 - 1)}{2 - 1}$ *(1)*
$= \frac{\frac{3}{2}(32 - 1)}{1}$ *(1)*
$= \frac{3}{2} x 31$
$= \frac{93}{2}$
$= 46.5$ *(1)*

20. A circle of radius 8 cm has a chord of length 8.2 cm.



Calculate the angle subtended by the chord at the centre of the circle.

(6 marks)

$AQ = BQ = 8cm$ *(radii)* *(1)*

$AB^2 = BQ^2 + AQ^2 - 2AQxQBxCos<AQB$ *(Cosine rule)* *(1)*

$q^2 = a^2 + b^2 - 2abCos<Q$

$8.2^2 = 8^2 + 8^2 - 2x8x8CosQ°$ *(1)*

$67.24 = 64 + 64 - 128\ CosQ°$

$67.24 - 128 = -128\ CosQ°$

$-60.76 = -128\ CosQ°$ *(1)*

$$CosQ° = \frac{-60.76}{-128}$$

$CosQ° = 0.4745$

$Q° = Cos^{-1}(0.4745)$ *(1)*

$= 61.67°$

$= 62°$ *(1)*

END OF PROVISIONAL MARKING KEY
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