

MUKAMENI AIC SENIOR SCHOOL

MID TERM ASSESSMENT

Essential Mathematics

Grade 10 · TERM 2, 2026

Name: _____

Adm No: _____

Stream: _____

Date: _____

Time: 2 HOURS

Instructions to candidates

- Write your Admission No. and sign in the spaces provided above.
- This paper consists of two sections; Section A and Section B.
- Section A: Answer all the questions in this section
Section B: Answer all the questions in this section.
- Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.
- Marks may be given for correct working even if the answer is wrong.
- Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.
- This paper contains 15 pages.
- Candidates should check and ensure all the pages are printed.

For Examiner's Use Only

Section A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

Section B

17	18	19	20	21	22	23	24	Total

Total Marks

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Section A (Answer all the questions in this section)

1. Simplify: $2^3 + 3^2 - 4$ (3 marks)

2. Simplify completely: $25^3 \times 125^2 \div 5^7$ leaving the answer in index form (4 marks)

3. The base of a triangle is 3 cm longer than its height and its area is 35 cm^2 . Determine the height and base of the triangle. (4 marks)

4. The area of a rhombus is 34 cm^2 . One of the interior angles is 30° . Calculate the length of a side of the rhombus to the nearest centimetre. (3 marks)

5. A regular pentagonal prism has base side 6 cm, base apothem 4.1 cm and length 15 cm. Calculate its total surface area. (4 marks)

6. A cone has radius 7 cm and vertical height 12 cm. Calculate its volume. Take $\pi = 22/7$. (3 marks)

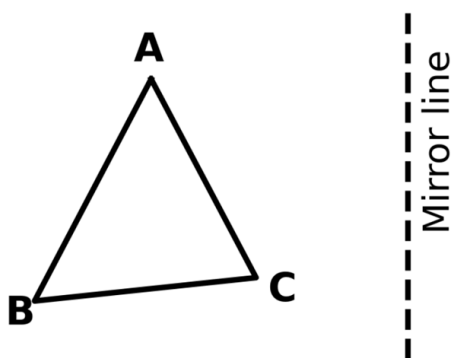
7. Simplify completely: $\frac{2}{3} \times \frac{9}{10} \div \frac{3}{5}$ (3 marks)

8. Evaluate: $12^0 + 2^3$ (2 marks)

9. The product of two consecutive whole numbers is 182. Find the two numbers. (3 marks)

10. A small triangular logo has angles 40° , 60° and 80° . A larger triangular logo has angles 80° , 40° and 60° . Determine whether the two logos are similar, giving a reason. (2 marks)

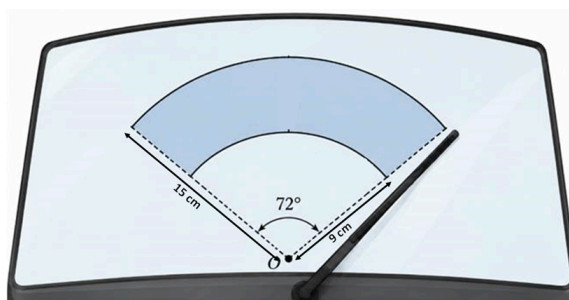
11. A triangular logo ABC is drawn on the left side of a vertical mirror line. Draw its image A'B'C' after reflection in the mirror line. (3 marks)



12. Solve for x in : $\cos(2x + 10^\circ) = \sin(3x - 5^\circ)$ (3 marks)

13. A triangular flower bed has two sides measuring 9 m and 12 m. The angle between the two sides is 45° . Calculate the area of the flower bed. (3 marks)

14. A windscreen wiper sweeps a curved region on a car windscreen. The outer radius of the swept region is 15 cm, the inner radius is 9 cm and the angle swept is 72° at the centre. Calculate the area swept by the wiper. Take $\pi = 22/7$. (3 marks)

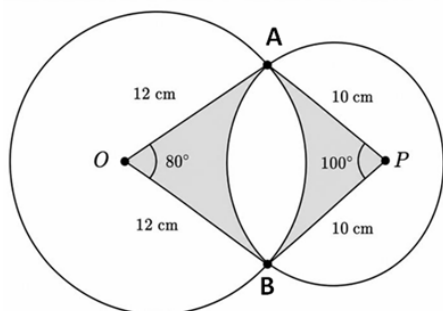


15. A solid cone-shaped ornament has a base radius of 5 cm and a slant height of 13 cm. Calculate its total surface area. Take $\pi = 3.142$. (3 marks)

16. A cone of height 45 cm has base radius 15 cm. A smaller cone of height 18 cm is cut off from the top. Calculate the radius of the smaller cone. (3 marks)

Section B (Answer all the questions in this section)

17. The figure below shows two intersecting circles with centres O and P . The radius of the larger circle is 12 cm and the angle subtended by the common chord AB at O is 80° . The radius of the smaller circle is 10 cm and the angle subtended by the same chord AB at P is 100° .



Taking $\pi = 3.142$,

(a) Calculate the area of quadrilateral $OAPB$. (4 marks)

(b) Calculate the total area of the shaded regions. (6 marks)

18. A school arranges chairs for a parents' meeting. The number of chairs in each row is 4 more than the number of rows. There are 165 chairs altogether.

(a) Let the number of rows be x . Write an expression for the number of chairs in each row. (1 mark)

.

.

(b) Form a quadratic equation in x . (2 marks)

(c) Solve the equation by factorisation and find the number of rows and the number of chairs in each row. (4 marks)

(d) If each chair is hired at KSh 25 and each row is labelled at a cost of KSh 10, calculate the total cost of hiring and labelling. (3 marks)

19. A wall of a building is 8 m high. In a photograph of the building, the height of the wall is 10 cm.

(a) (i) Find the height of a door in the photograph if its actual height is 2.4 m. (3 marks)

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(ii) The area of a window on the photograph is 1.4 cm^2 . Calculate the actual area of the window. (3 marks)

.

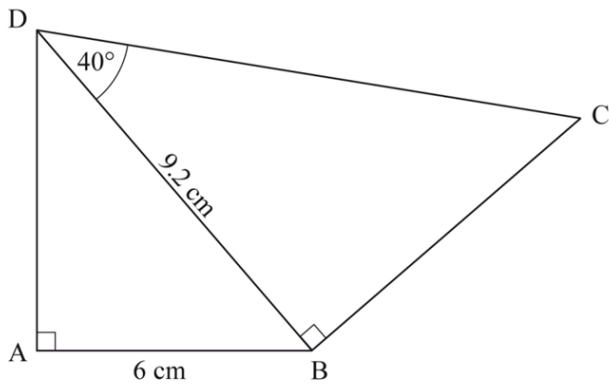
(b) The surface areas of two similar cuboids are 16 cm^2 and 49 cm^2 .

(i) Find the volume scale factor of the cuboids. (2 marks)

.

(ii) If the volume of the smaller cuboid is 128 cm^3 , determine the volume of the bigger cuboid. (2 marks)

20. In the figure, triangle ABD is right-angled at A. $AB = 6$ cm and $BD = 9.2$ cm.



Using triangle ABD, calculate, correct to the required degree of accuracy:

- (a) the length AD, correct to 1 decimal place. (2 marks)

.

- (b) With respect to angle ABD, name the:

- (i) opposite side;
- (ii) adjacent side;
- (iii) hypotenuse. (3 marks)

.

- (c) Determine, correct to 3 decimal places:

- (i) $\sin ABD$; (1 mark)
- (ii) $\cos ABD$; (1 mark)
- (iii) $\tan ABD$. (1 mark)

.

- (d) Calculate the size of angle ABD, correct to 1 decimal place. (2 marks)

21. A cattle ranch is in the shape of a parallelogram. The length of one side is 600 m and the other is 500 m. The smaller angle between the sides is 30° .

(a) Calculate the area, in hectares, of the ranch. (3 marks)

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(b) A water point in the shape of a regular hexagon of side 10 m is built in the ranch. Calculate:

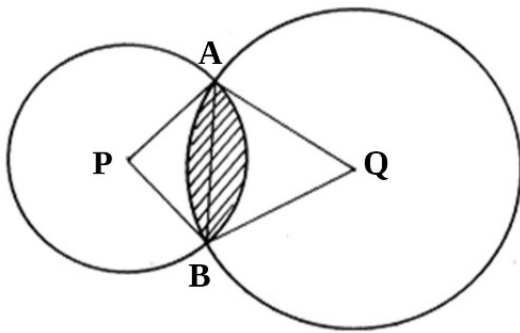
(i) the grazing area, in hectares, correct to 3 decimal places. (4 marks)

.

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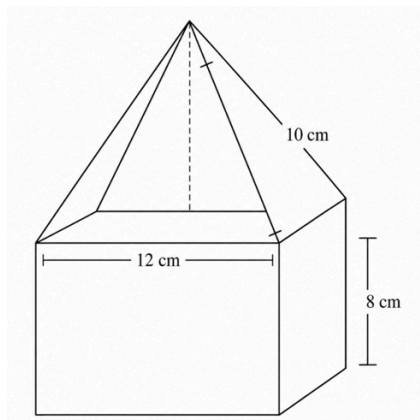
(ii) the number of cattle that can be kept in the ranch if one animal requires a grazing area of 0.625 ha. (3 marks)

22. The figure below shows two intersecting circles with centres P and Q. The radius of the smaller circle is 5 cm. The radius of the larger circle is 6 cm. AB is a common chord of length 8 cm.



- (a) Calculate the length of PQ. (2 marks)
- .
- (b) Calculate the sizes of angles APB and AQB. (5 marks)
- .
- .
- .
- (c) Calculate the area of the shaded region. (3 marks)

23. The figure below shows a solid made by fixing a square-based pyramid on top of a cuboid. The cuboid has a square top of side 12 cm and height 8 cm. The pyramid has the same square base of side 12 cm and a slant height of 10 cm.



(a) Calculate the area of the exposed faces of the cuboid. (4 marks)

(b) Calculate the total area of the four triangular faces of the pyramid. (3 marks)

(c) One small tin of paint covers 250 cm^2 . Determine the minimum number of tins needed to paint the external surface of the solid. (3 marks)

24. A square-based pyramid of height 30 cm has base side 18 cm. A smaller similar pyramid of height 10 cm is cut off from the top to form a frustum.

(a) Find the side of the square base of the smaller pyramid. (2 marks)

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.
.

(b) Calculate the volume of the frustum formed. (4 marks)

(c) Calculate the capacity of the frustum in litres. (2 marks)

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.

(d) Water flows into the frustum at a rate of 0.6 litres per minute. Calculate the time taken to fill the frustum, correct to the nearest minute. (2 marks)

MARKING SCHEME

ESSENTIAL MATHEMATICS MARKING SCHEME

Section A (Answer all the questions in this section)

1. $2^3 = 8$ and $3^2 = 9$. ✓ B1
 $8 + 9 - 4$. ✓ M1
 $= 13$. ✓ A1

2. $25 = 5^2$ and $125 = 5^3$. ✓ B1
 $25^3 = (5^2)^3 = 5^6$ and $125^2 = (5^3)^2 = 5^6$. ✓ M1
Expression becomes $5^6 \times 5^6 \div 5^7 = 5^{12} \div 5^7$. ✓ M1
 $= 5^5$. ✓ A1

3. Let the height of the triangle be x cm.
Base = $x + 3$ cm B1
Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height}$
 $35 = \frac{1}{2} \times x(x + 3)$
 $70 = x(x + 3)$
 $x^2 + 3x - 70 = 0$ M1
 $x^2 + 10x - 7x - 70 = 0$
 $x(x + 10) - 7(x + 10) = 0$
 $(x + 10)(x - 7) = 0$ M1
 $x = -10$ or $x = 7$
Since length cannot be negative,
height = 7 cm
base = $7 + 3$
 $= 10$ cm A1
Height = 7 cm, Base = 10 cm

4. Let the side of the rhombus be x cm.
Area of rhombus = $x^2 \sin 30^\circ$ — M1
 $34 = x^2 \times \frac{1}{2}$
 $x^2 = 68$ — M1
 $x = \sqrt{68}$
 $x = 8.246\dots$
 $x = 8$ cm, to the nearest centimetre — A1

5. A regular pentagonal prism has base side 6 cm, base apothem 4.1 cm and length 15 cm. Calculate its total surface area. (4 marks)

Solution:

Perimeter of pentagonal base = 5×6

Perimeter = 30 cm M1

Area of two pentagonal ends = $2 \times \frac{1}{2} \times 30 \times 4.1$
 Area of two pentagonal ends = 123 cm^2 M1
 Area of rectangular faces = 30×15
 Area of rectangular faces = 450 cm^2 M1
 Total surface area = $123 + 450$
 Total surface area = 573 cm^2 A1

6. A cone has radius 7 cm and vertical height 12 cm. Calculate its volume. Take $\pi = 22/7$. (3 marks)

Solution:

Volume of cone = $\frac{1}{3}\pi r^2 h$
 Volume = $\frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 12$ M1
 Volume = $\frac{1}{3} \times 1848$ M1
 Volume = 616 cm^3 A1

7. Change division to multiplication by the reciprocal: $\frac{2}{3} \times \frac{9}{10} \times \frac{5}{3}$. ✓ M1
 = $\frac{90}{90}$. ✓ M1
 = 1. ✓ A1

8. $12^0 = 1$ and $2^3 = 8$. ✓ B1
 $1 + 8 = 9$. ✓ A1

9. The product of two consecutive whole numbers is 182. Find the two numbers. (3 marks)

SOLUTION

Let the smaller number be x.
 The next consecutive whole number = $x + 1$ B1
 $x(x + 1) = 182$
 $x^2 + x - 182 = 0$ M1
 $x^2 + 14x - 13x - 182 = 0$
 $x(x + 14) - 13(x + 14) = 0$
 $(x + 14)(x - 13) = 0$
 $x = -14$ or $x = 13$
 Reject $x = -14$.
 The numbers are 13 and 14. A1
 Total = 3 marks

10. A small triangular logo has angles 40° , 60° and 80° . A larger triangular logo has angles 80° , 40° and 60° . Determine whether the two logos are similar, giving a reason. (2 marks)

SOLUTION

Angles of the small triangular logo are 40° , 60° and 80° .
 Angles of the larger triangular logo are 80° , 40° and 60° .
 The corresponding angles are equal. M1
 Therefore, the two triangular logos are similar. A1
 Total = 2 marks

11. A triangular logo ABC is drawn on the left side of a vertical mirror line. Draw its image A'B'C' after reflection in the mirror line. (3 marks)

SOLUTION

Draw perpendicular lines from points A, B and C to the vertical mirror line. M1

Extend each perpendicular line to the right side of the mirror line and mark A', B' and C' such that each image point is the same distance from the mirror line as its corresponding object point. M1

Join A', B' and C' to form triangle A'B'C'. The image should be the same size and shape as triangle ABC, but facing the opposite direction. A1

Total = 3 marks

12. Solve for x: $\cos(2x + 10^\circ) = \sin(3x - 5^\circ)$ (3 marks)

Solution

Since sine and cosine of complementary angles are equal,

$$(2x + 10^\circ) + (3x - 5^\circ) = 90^\circ \dots\dots\dots \text{M1}$$

$$2x + 10^\circ + 3x - 5^\circ = 90^\circ$$

$$5x + 5^\circ = 90^\circ \dots\dots\dots \text{M1}$$

$$5x = 85^\circ$$

$$x = 17^\circ \dots\dots\dots \text{A1}$$

Total = 3 marks

13. A triangular flower bed has two sides measuring 9 m and 12 m. The angle between the two sides is 45° . Calculate the area of the flower bed. (3 marks)

SOLUTION

Let the area of the flower bed be A m².

Using area of a triangle:

$$\text{Area} = \frac{1}{2}ab \sin \theta$$

$$A = \frac{1}{2} \times 9 \times 12 \times \sin 45^\circ \dots\dots\dots \text{M1}$$

$$A = 54 \times 0.7071 \dots\dots\dots \text{M1}$$

$$A = 38.18 \text{ m}^2 \dots\dots\dots \text{A1}$$

Total 3 marks

14. A windscreen wiper sweeps a curved region on a car windscreen. The outer radius of the swept region is 15 cm, the inner radius is 9 cm and the angle swept is 72° at the centre. Calculate the area swept by the wiper. Take $\pi = 22/7$. (3 marks)

Solution:

$$\text{Area swept} = \frac{\theta}{360} \times \pi(R^2 - r^2)$$

$$\text{Area} = \frac{72}{360} \times \frac{22}{7} \times (15^2 - 9^2) \dots\dots\dots \text{M1}$$

$$\text{Area} = \frac{72}{360} \times \frac{22}{7} \times (225 - 81) \dots\dots\dots \text{M1}$$

$$\text{Area} = 90.51 \text{ cm}^2 \dots\dots\dots \text{A1}$$

15. A solid cone-shaped ornament has a base radius of 5 cm and a slant height of 13 cm. Calculate its total surface area. Take $\pi = 3.142$. (3 marks)

Solution:

$$\text{Total surface area of cone} = \pi rl + \pi r^2$$

$$\text{Surface area} = 3.142 \times 5 \times 13 + 3.142 \times 5^2 \dots\dots\dots \text{M1}$$

$$\text{Surface area} = 204.23 + 78.55 \dots\dots\dots \text{M1}$$

$$\text{Surface area} = 282.78 \text{ cm}^2 \dots\dots\dots \text{A1}$$

16. A cone of height 45 cm has base radius 15 cm. A smaller cone of height 18 cm is cut off from the top. Calculate the radius of the smaller cone. (3 marks)

Solution:

Using similarity of cones:

$$\text{Radius of smaller cone} / \text{Radius of larger cone} = \text{Height of smaller cone} / \text{Height of larger cone}$$

$$\begin{aligned} r/15 &= 18/45 \dots\dots\dots \text{M1} \\ r &= 15 \times 18/45 \dots\dots\dots \text{M1} \\ r &= 6 \text{ cm} \dots\dots\dots \text{A1} \end{aligned}$$

Section B (Answer all the questions in this section)

17. The figure below shows two intersecting circles with centres O and P. The radius of the larger circle is 12 cm and the angle subtended by the common chord AB at O is 80° . The radius of the smaller circle is 10 cm and the angle subtended by the same chord AB at P is 100° . Taking $\pi = 3.142$,

(a) Calculate the area of quadrilateral OAPB. (4 marks)

(b) Calculate the total area of the shaded regions. (6 marks)

Solution:

(a)

$$\begin{aligned} \text{Area of triangle OAB} &= \frac{1}{2} \times 12 \times 12 \times \sin 80^\circ \\ \text{Area of triangle OAB} &= 70.91 \text{ cm}^2 \dots\dots\dots \text{M1} \\ \text{Area of triangle APB} &= \frac{1}{2} \times 10 \times 10 \times \sin 100^\circ \\ \text{Area of triangle APB} &= 49.24 \text{ cm}^2 \dots\dots\dots \text{M1} \\ \text{Area of quadrilateral OAPB} &= 70.91 + 49.24 \dots\dots\dots \text{M1} \\ \text{Area of quadrilateral OAPB} &= 120.15 \text{ cm}^2 \dots\dots\dots \text{A1} \end{aligned}$$

(b)

$$\begin{aligned} \text{Area of sector OAB} &= \frac{80}{360} \times 3.142 \times 12 \times 12 \\ \text{Area of sector OAB} &= 100.54 \text{ cm}^2 \dots\dots\dots \text{M1} \\ \text{Area of segment in larger circle} &= 100.54 - 70.91 \\ \text{Area of segment in larger circle} &= 29.63 \text{ cm}^2 \dots\dots\dots \text{M1} \\ \text{Area of sector APB} &= \frac{100}{360} \times 3.142 \times 10 \times 10 \\ \text{Area of sector APB} &= 87.28 \text{ cm}^2 \dots\dots\dots \text{M1} \\ \text{Area of segment in smaller circle} &= 87.28 - 49.24 \\ \text{Area of segment in smaller circle} &= 38.04 \text{ cm}^2 \dots\dots\dots \text{M1} \\ \text{Area of unshaded common region} &= 29.63 + 38.04 \\ \text{Area of unshaded common region} &= 67.67 \text{ cm}^2 \dots\dots\dots \text{M1} \\ \text{Total area of shaded regions} &= 120.15 - 67.67 \\ \text{Total area of shaded regions} &= 52.48 \text{ cm}^2 \dots\dots\dots \text{A1} \end{aligned}$$

18. A school arranges chairs for a parents' meeting. The number of chairs in each row is 4 more than the number of rows. There are 165 chairs altogether.

SOLUTION

(a) Let the number of rows be x. Write an expression for the number of chairs in each row. (1 mark)

$$\text{Number of chairs in each row} = x + 4 \dots\dots\dots \text{B1}$$

(b) Form a quadratic equation in x. (2 marks)

$$\text{Total number of chairs} = \text{number of rows} \times \text{number of chairs in each row}$$

$$\begin{aligned} x(x + 4) &= 165 \dots\dots\dots \text{M1} \\ x^2 + 4x - 165 &= 0 \dots\dots\dots \text{A1} \end{aligned}$$

(c) Solve the equation by factorisation and find the number of rows and the number of chairs in each row. (4 marks)

$$\begin{aligned} x^2 + 4x - 165 &= 0 \\ x^2 + 15x - 11x - 165 &= 0 \dots\dots\dots \text{M1} \\ x(x + 15) - 11(x + 15) &= 0 \\ (x + 15)(x - 11) &= 0 \dots\dots\dots \text{M1} \\ x + 15 &= 0 \text{ or } x - 11 = 0 \\ x &= -15 \text{ or } x = 11 \dots\dots\dots \text{M1} \\ \text{Reject } x &= -15. \\ \text{Number of rows} &= 11 \end{aligned}$$

Number of chairs in each row = $11 + 4 = 15$ A1

(d) If each chair is hired at KSh 25 and each row is labelled at a cost of KSh 10, calculate the total cost of hiring and labelling. (3 marks)

Cost of hiring chairs = 165×25

= KSh 4,125 M1

Cost of labelling rows = 11×10

= KSh 110 M1

Total cost = $4,125 + 110$

= KSh 4,235 A1

Total = 10 marks

19. (a)

(i)

Actual wall height = 8 m = 800 cm

Linear scale factor = $\frac{10}{800} = \frac{1}{80}$ — M1

Actual door height = 2.4 m = 240 cm

Height of door in photograph = $240 \times \frac{1}{80}$ — M1

= 3 cm — A1

(ii)

Area scale factor = $(\frac{1}{80})^2$

= $\frac{1}{6400}$ — M1

Actual area = $1.4 \times 6400 \text{ cm}^2$ — M1

= 8960 cm^2

= 0.896 m^2 — A1

(b)

(i)

Surface area scale factor = 16 : 49

Linear scale factor = $\sqrt{16} : \sqrt{49}$

= 4 : 7 — M1

Volume scale factor = $4^3 : 7^3$

= 64 : 343 — A1

(ii)

Volume of bigger cuboid = $128 \times \frac{343}{64}$ — M1

= 686 cm^3 — A1

(a) Length AD — 2 marks

$$AD^2 = BD^2 - AB^2 \quad \text{M1}$$

$$AD^2 = 9.2^2 - 6^2 = 84.64 - 36 = 48.64$$

$$AD = \sqrt{48.64} = 6.974 \dots = 7.0 \text{ cm} \quad \text{A1}$$

(b) Sides with respect to angle ABD — 3 marks

$$\text{Opposite side} = AD \quad \text{B1}$$

$$\text{Adjacent side} = AB \quad \text{B1}$$

$$\text{Hypotenuse} = BD \quad \text{B1}$$

(c) Trigonometric ratios — 3 marks

$$\sin ABD = \frac{AD}{BD} = \frac{6.974 \dots}{9.2} = 0.758 \quad \text{B1}$$

$$\cos ABD = \frac{AB}{BD} = \frac{6}{9.2} = 0.652 \quad \text{B1}$$

$$\tan ABD = \frac{AD}{AB} = \frac{6.974 \dots}{6} = 1.162 \quad \text{B1}$$

(d) Size of angle ABD — 2 marks

$$\cos ABD = \frac{6}{9.2} \quad \text{M1}$$

$$ABD = \cos^{-1} \left(\frac{6}{9.2} \right) = 49.3^\circ \quad \text{A1}$$

20.

21. (a)

Area of parallelogram = $ab \sin \theta$

$$= 600 \times 500 \times \sin 30^\circ \dots\dots\dots \text{M1}$$

$$= 600 \times 500 \times \frac{1}{2}$$

$$= 150000 \text{ m}^2 \dots\dots\dots \text{M1}$$

Convert to hectares:

$$10000 \text{ m}^2 = 1 \text{ ha}$$

$$150000 \text{ m}^2 = \frac{150000}{10000}$$

$$= 15 \text{ ha} \dots\dots\dots \text{A1}$$

Answer: 15 ha

(b)(i)

Area of regular hexagon = $6 \times$ area of one equilateral triangle

$$= 6 \times \frac{1}{2} \times 10 \times 10 \times \sin 60^\circ \dots\dots\dots \text{M1}$$

$$= 259.8076 \text{ m}^2 \text{ B1}$$

Convert to hectares:

$$259.8076 \text{ m}^2 = \frac{259.8076}{10000}$$

$$= 0.02598076 \text{ ha M1}$$

$$\text{Grazing area} = 15 - 0.02598076$$

$$= 14.97401924 \text{ ha}$$

$$= 14.974 \text{ ha} \dots\dots\dots \text{A1}$$

Answer: 14.974 ha

(b)(ii)

Number of cattle = grazing area / area required per animal

$$= 14.97401924 / 0.625 \dots\dots\dots M1$$

$$= 23.9584 \text{ B1}$$

Therefore, the number of cattle that can be kept is:

$$23 \text{ cattle} \dots\dots\dots A1$$

Answer: 23 cattle

22. (a) Find PM and QM.

$$PM = \sqrt{5^2 - 4^2} = 3.$$

$$QM = \sqrt{6^2 - 4^2} = \sqrt{20} = 2\sqrt{5}.$$

$$\text{So, } PQ = PM + QM = 3 + 2\sqrt{5} = 7.47 \text{ cm.}$$

(B1)

(b) (i) Use $\sin(APB/2) = 4/5$.

$$\text{So, } APB/2 = \sin^{-1}(4/5).$$

$$\text{Hence, } APB = 2\sin^{-1}(4/5) = 106.3^\circ.$$

(M1)

(A1)

(ii) Use $\sin(AQB/2) = 4/6 = 2/3$.

$$\text{So, } AQB/2 = \sin^{-1}(2/3).$$

$$\text{Hence, } AQB = 2\sin^{-1}(2/3) = 83.6^\circ.$$

(M1)

(A1)

(c) Find the area of the overlap.

$$\text{Area of overlap} = \text{area of sector APB} + \text{area of sector AQB} - \text{area of triangle APB} - \text{area of triangle AQB.}$$

(M1)

Substitute the values.

$$= (106.3/360) \times \pi \times 5^2 + (83.6/360) \times \pi \times 6^2.$$

(M1)

Then subtract the two triangle areas.

$$- 1/2 \times 5^2 \times \sin 106.3^\circ - 1/2 \times 6^2 \times \sin 83.6^\circ.$$

(M1)

Simplify.

$$= 13.40 + 26.27 - 12.00 - 17.89.$$

$$= 9.78 \text{ cm}^2.$$

(A1)

23. The figure below shows a solid made by fixing a square-based pyramid on top of a cuboid. The cuboid has a square top of side 12 cm and height 8 cm. The pyramid has the same square base of side 12 cm and a slant height of 10 cm.

(a) Calculate the area of the exposed faces of the cuboid. (4 marks)

(b) Calculate the total area of the four triangular faces of the pyramid. (3 marks)

(c) One small tin of paint covers 250 cm². Determine the minimum number of tins needed to paint the external surface of the solid. (3 marks)

Solution:

(a)

$$\text{Area of four vertical faces of cuboid} = 4 \times 12 \times 8$$

$$\text{Area} = 384 \text{ cm}^2 \dots\dots\dots M1$$

$$\text{Area of bottom face} = 12 \times 12$$

$$\text{Area} = 144 \text{ cm}^2 \dots\dots\dots M1$$

Top square face is covered by the pyramid, so it is not included B1

$$\text{Area of exposed faces of cuboid} = 384 + 144$$

$$\text{Area} = 528 \text{ cm}^2 \dots\dots\dots A1$$

(b)

Area of one triangular face = $\frac{1}{2} \times 12 \times 10$

Area of one triangular face = 60 cm^2 M1

Area of four triangular faces = 4×60

Area of four triangular faces = 240 cm^2 A2

(c)

Total external surface area = $528 + 240$

Total external surface area = 768 cm^2 M1

Number of tins = $768 \div 250$

Number of tins = 3.072 M1

Minimum number of tins needed = 4 tins A1

24. A square-based pyramid of height 30 cm has base side 18 cm. A smaller similar pyramid of height 10 cm is cut off from the top to form a frustum.

(a) Find the side of the square base of the smaller pyramid. (2 marks)

(b) Calculate the volume of the frustum formed. (4 marks)

(c) Calculate the capacity of the frustum in litres. (2 marks)

(d) Water flows into the frustum at a rate of 0.6 litres per minute. Calculate the time taken to fill the frustum, correct to the nearest minute. (2 marks)

Solution:

(a)

Using similarity:

Side of smaller pyramid / Side of larger pyramid = Height of smaller pyramid / Height of larger pyramid

$x/18 = 10/30$ M1

$x = 18 \times 10/30$

$x = 6 \text{ cm}$ A1

(b)

Volume of larger pyramid = $\frac{1}{3} \times 18 \times 18 \times 30$

Volume of larger pyramid = 3240 cm^3 M1

Volume of smaller pyramid = $\frac{1}{3} \times 6 \times 6 \times 10$

Volume of smaller pyramid = 120 cm^3 M1

Volume of frustum = $3240 - 120$ M1

Volume of frustum = 3120 cm^3 A1

(c)

Capacity = $3120 \div 1000$ litres M1

Capacity = 3.12 litres A1

(d)

Time = capacity $\div$ rate

Time = $3.12 \div 0.6$ M1

Time = 5.2 minutes

Time taken = 5 minutes, correct to the nearest minute A1
