GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

RE ARATORY E AM NATION

023

11092
TECHNICAL ATHEMATICS
(APER 2)

TIME: 3 hours

ARKS: 150

TEGNIESE WISKUNDE: Vraestel 2

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X05

13 p ges + a 2 p ge information sheet and a 27 page answer book

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This paper consists of TWELVE questions.

2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.

3. Number the answers correctly according to the numbering system used in this paper.

4. Show ALL calculations, diagrams, graphs, etc. what you used to determine your answers, clearly.

5. Full marks will NOT necessarily be awarded to answers only.

6. You may use an approved scientific calculator (non-programmable and non-graphical), unless otherwise stated.

7. If necessary, round answers to TWO decimal places, unless otherwise stated.

8. Diagrams are NOT necessarily drawn to scale.

9. Write neatly and legibly.

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QUESTION 1

The diagram below shows ΔABC with vertices A(–3; –4); B(1; 3) and C(3; –1). Line AB intersects the x-as at point D and is the angle of inclination of line BC.
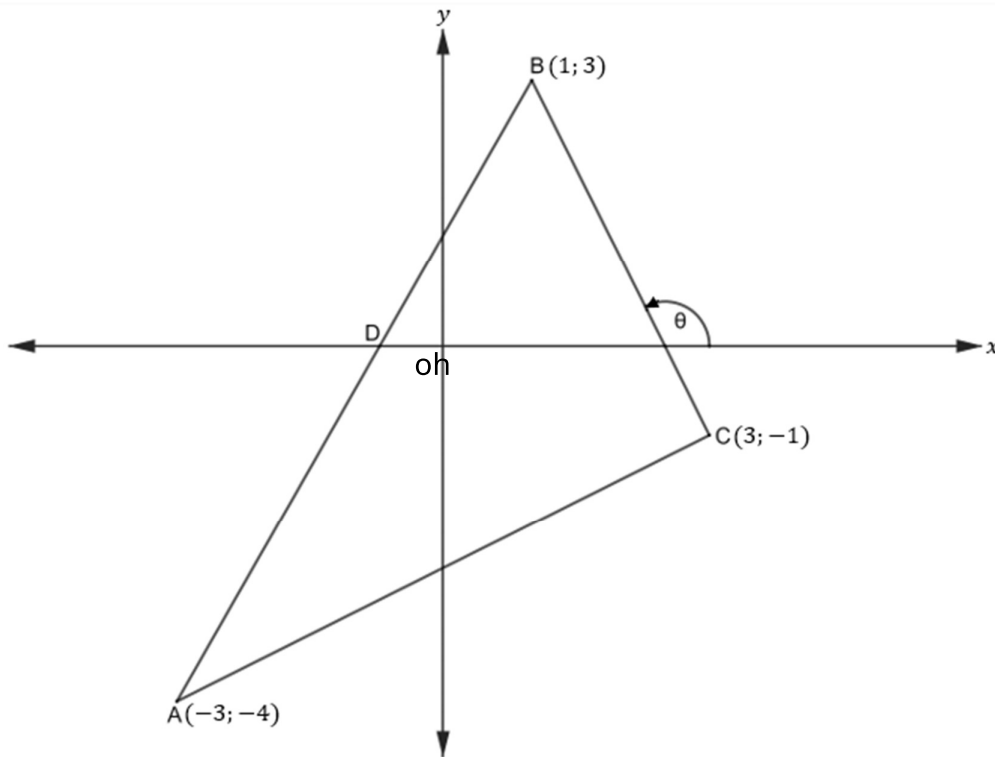

1.1 Calculate the length of line AB. (correct to TWO decimal places) (3)

1.2 Determine the coordinates of M, the midpoint of AC. (2)

1.3 Calculate the coordinates of D. (4)

1.4 Calculate the size of ,correct to two decimal places, if the slope of BC is – 2. (2)

1.5 If the equation of the straight line BC is given by y = –2x+5, calculate the possible x-coordinates of S, as S a point up B.C is and OS = $\sqrt{5}$ units. O is at the origin. (4)

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QUESTION 2

2.1 In the diagram below, points P(–3; –4) and Q(4; –3) are sketched with tangents PR and QR from R to the circle with center O(0; 0).
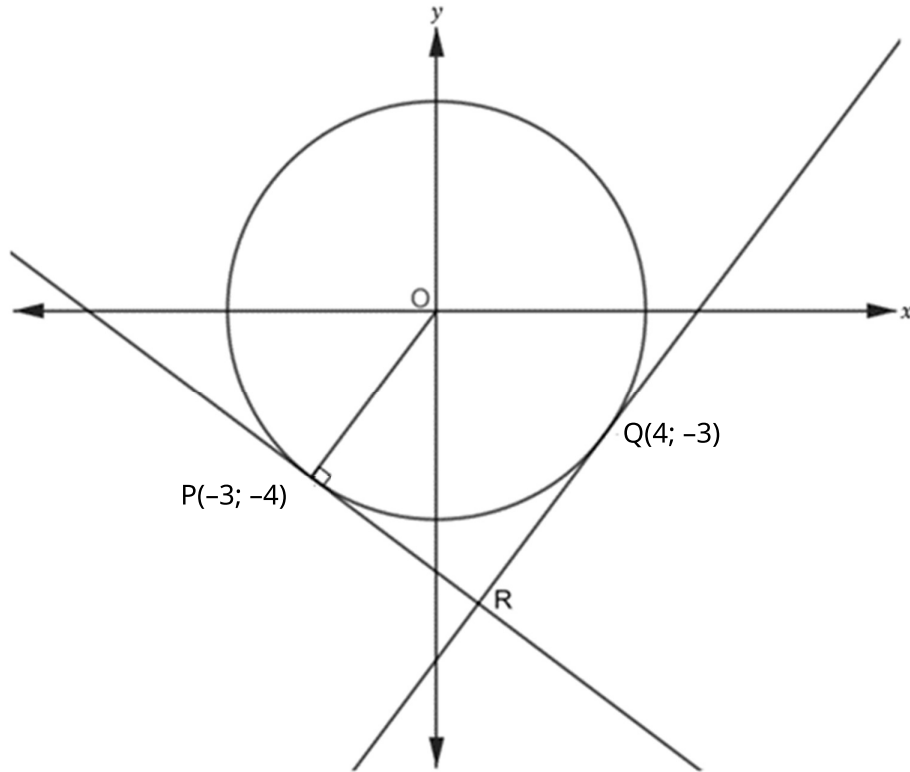
    2.1.1 Determine the equation of the circle. (2)

    2.1.2 Show that the equation of tangent PR $3x+4y=25$ is. (3)

    2.1.3 Next determine the coordinates of R if the equation of tangent RQ $4x–3y=25$ is. (5)

2.2 Sketch the graph defined by:

$$\overline{49} \quad \overline{25} \quad 1$$

Clearly show ALL intercepts with the axes. (3)

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above

QUESTION 3

3.1 Given: A = 40° and C = 50°.**Without the use of a calculator**, determine the value of the following:

    3.1.1 cos (A + C)   (1)

    3.1.2 $\cos\dfrac{90° \quad 2A \quad C}{180° \quad 3C}$ (4)

3.2 If cos 36° = , determine, using an appropriate diagram:

    3.2.1 The value of x (2)

    3.2.2 Next, determine the value of the third side of the triangle.   (2)

3.3 Determine the numerical value of sentence   − , **without the use of a calculator**.   (2)

                                                          [11]

QUESTION 4

4.1 Complete the following identity:1   ...   (1)

4.2 Simplify,**without the use of a calculator**, the following trigonometric expression:

    $\dfrac{\tan 180° \quad . \sin 180°}{360° \quad \beta}$ (7)

4.3 Show that   1   (3)

4.4 Determine the value(s) of as2 tan   10° 3.464and ∈ 0° ; 360°.   (4)

                                                           [15]

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QUESTION 5

Gave: 2 and 2 for0° 360°.

5.1 Draw a sketch graph of *f* and *g* on the same axis system on the grid provided in the ANSWER BOOK. Clearly indicate ALL pivot points, end points and intersections with the axes. (6)

5.2 Write down the period of . (1)

5.3 Use the graph in QUESTION 5.1 and calculate the value(s) of what for
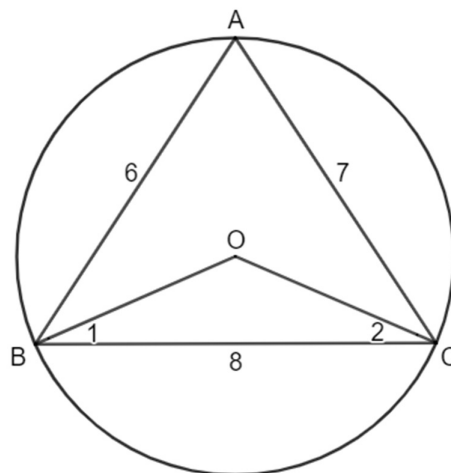2 2 0. (2)

5.4 Write the value collection of *g* down (2)

[11]

QUESTION 6

In the diagram below, O is the center of the circle. AB = 6 units, AC = 7 units and BC = 8 units.

6.1 Show, using appropriate calculations, thatBAC =75.5°. (4)

6.2 Determine, with a reason, the size ofBOC. (2)

6.3 Calculate the diameter of the circle. (correct to TWO decimal places) (4)

6.4 Calculate the area ofΔBOC. (correct to ONE decimal place) (2)

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above

QUESTION 7

7.1 Complete the following statement:

The angle formed between the tangent to a circle and a chord drawn from the tangent is equal to... (1)

7.2 In the diagram below, A, B, C, E and F are points on the circumference of the circle with center O. Tangents ED and CD are sketched where they pass through E and C respectively and both meet at point D.OEC =35°.
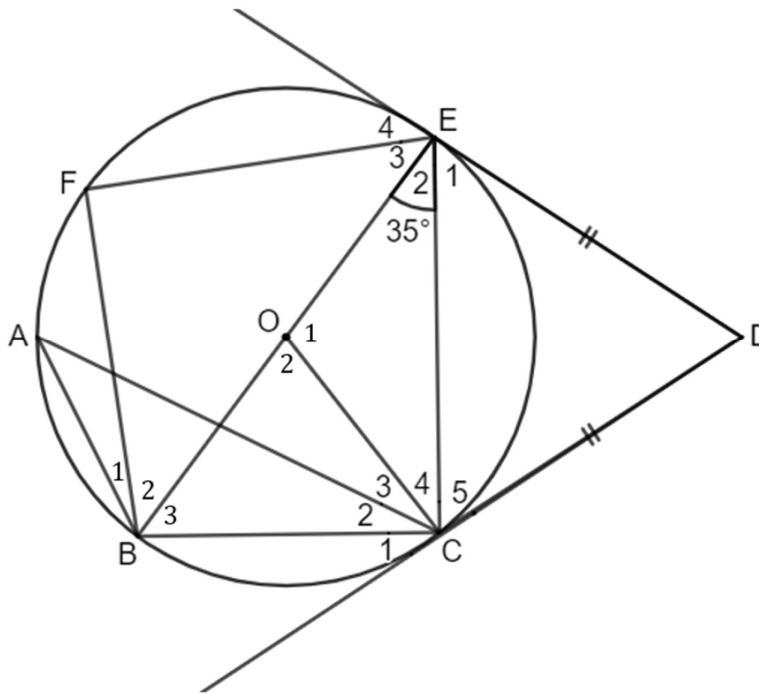
7.2.1 Why is CE? (1)

7.2.2 Determine, with reasons, three other angles in the diagram that are equal to 35°. (3)

7.2.3 Determine, with reasons, the size ofC. (3)

7.2.4 What is the relationship betweenEOCandCBO? (2)

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QUESTION 8

8.1 Complete the following statement:

If two triangles are equiangular, their ... sides are in proportion (and therefore the triangles are congruent). (1)

8.2 InΔABCbelow, D, E and F are points on AB, AC and BC respectively.

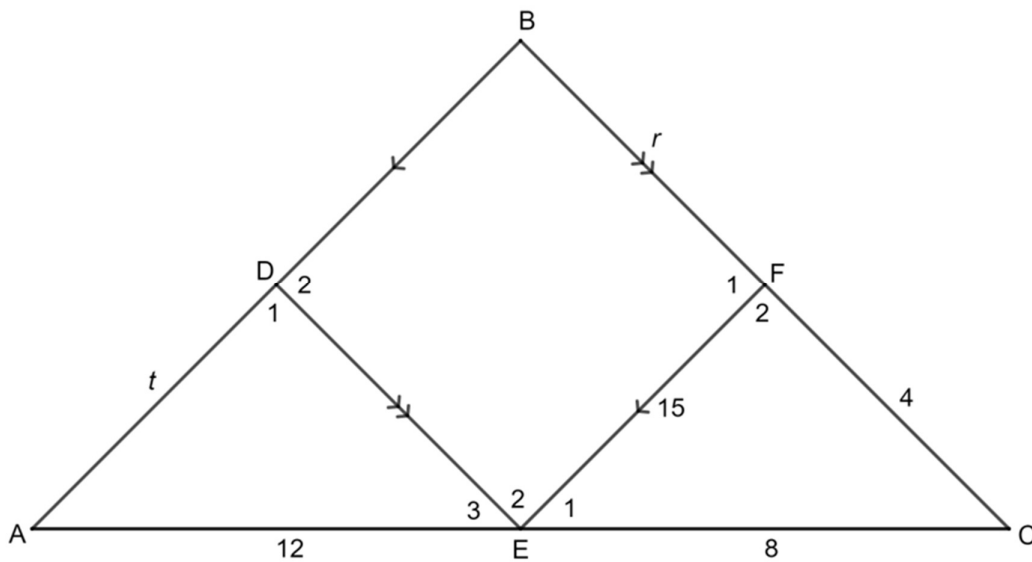DE∥BC and EF∥AB.

AE = 12 units	EC = 8 units
CF = 4 units	BF = r
DA = t	EF = 15 units

8.2.1 Calculate, with reasons, the numerical value of r. (3)

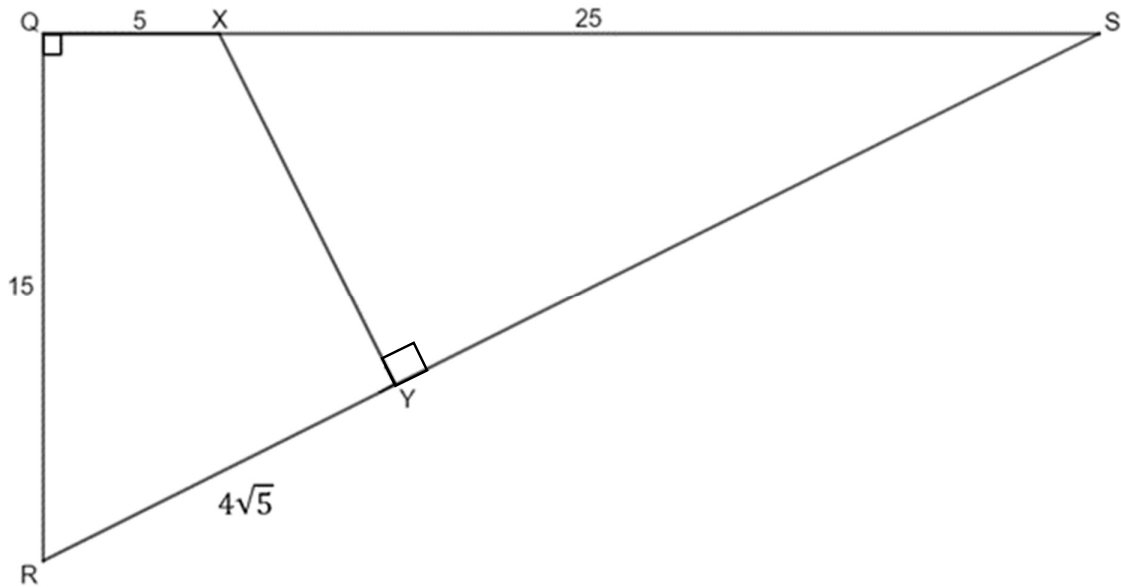8.2.2 What type of quadrilateral is BDEF? Give a reason for the answer. (2)

8.2.3 Next, calculate, with reasons, the numerical value of t. (3)

8.2.4 Show next, using appropriate calculations, that ΔADE ||| ΔEFC. (4)

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QUESTION 9

In the diagram below, QX = 5 units, XS = 25 units, QR = 15 units and RY =4 $\sqrt{5}$units. $\overline{RQS}$ =90° and XYS =90°.

9.1 9.1.1 Prove that$\triangle$SYX|||$\triangle$SQR. (4)

9.1.2 Complete the following:

$$\frac{HIS}{SX} = \frac{SQ}{\ldots}$$ (1)

9.1.3 Next, determine the numerical value of HIS. (correct to TWO decimal places) (4)

9.2 If XY 5$\sqrt{5}$units, de$\overline{te}$rmine the:

9.2.1 $\dfrac{\text{Surface} \quad \triangle SYX}{\text{Surface} \quad \triangle SQR}$ (3)

9.2.2 Area of quadrilateral QRYX (3)

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QUESTION 10

In the picture below, on the left side of the frame, is a circular cutting machine that has a blade that rotates at 11,000 revolutions per minute.

Next to the picture is a diagram, not drawn to scale, with circle O with a radius of 16 cm and a central angleAOC =120°.

Points A, B and C are on the circle. Dotted line AC is a chord that divides the circle into two segments.
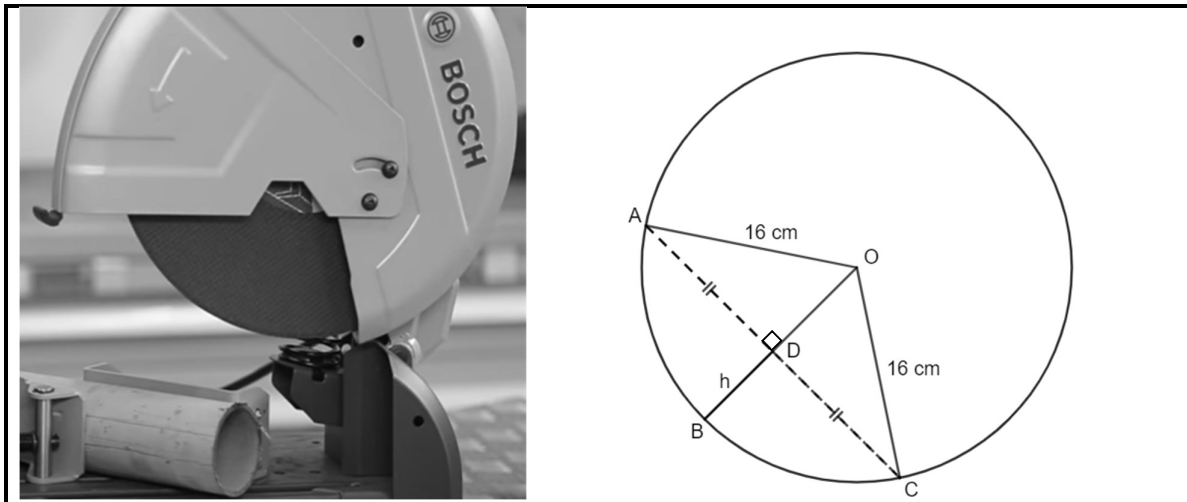
Calculate the following:

10.1   The rotation frequency of the blade in revolutions per second   (1)

10.2   The peripheral velocity of the blade in meters per second   (3)

10.3   The angular velocity of the blade in radians per second   (3)

10.4   The height of the small segment   (3)

10.5 The length of chord AC   (3)

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QUESTION 11

The picture below shows a piece of stainless steel pipe used in the exhaust system of a vehicle. This one has an 80° bend. The diagram on the right shows the circular shape where MSN represents the bending of the picture on the left. In the diagram, radii =7 cm (OM) and =3 cm (OT). They represent the inside and outside diameter of the bend. Point M and N are on the circle with arc length S and center O.
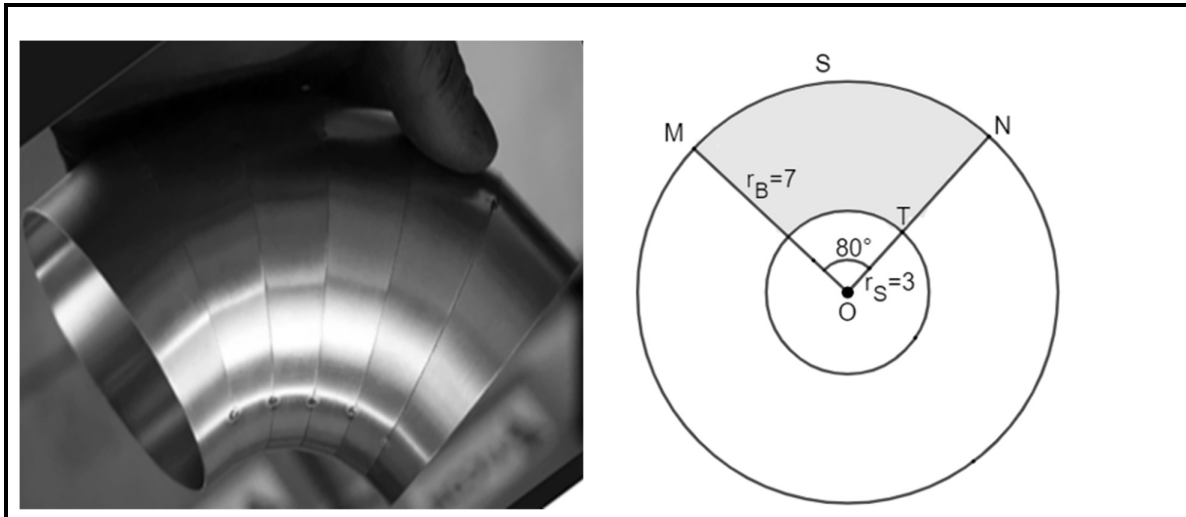

11.1 Redirect80°to radials. (correct to ONE decimal place) (1)

11.2 Calculate the arc length S with central angle 80°. (3)

11.3 Calculate the area of the shaded section of the stainless steel pipe represented by the picture on the right. (4)

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QUESTION 12

12.1 An art student makes a clay bowl that is 8 cm high and has a radius of 9 cm at the top and 3 cm at the base. To make the bowl, he follows the instructions below given by a Grade 11 Technical Mathematics teacher was given to him.

Step 1: Build a hollow cone with a slant height of 15 cm and a radius of 9 cm.

Step 2: Up to date ,cut the cone and build a solid base for the bowl with a radius of 3 cm.
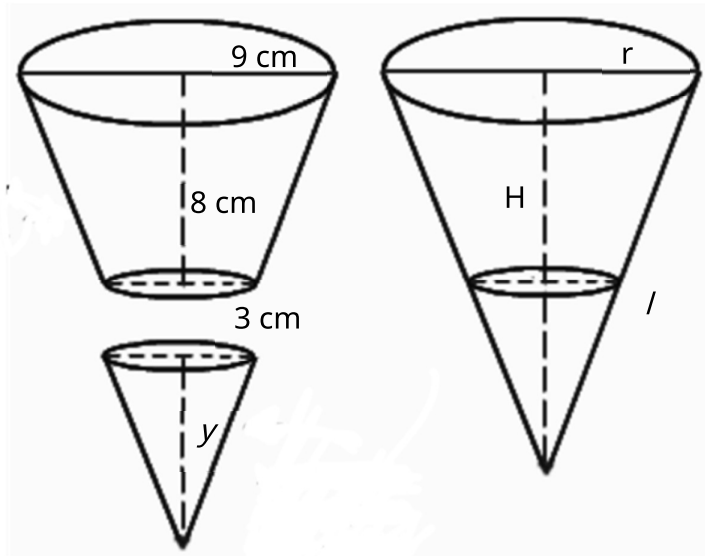
The following formula can be used to answer this question:

Closed cone

$$\frac{1}{3}$$

TSA   −   circumference of the base   slope height area of base

TSA $\frac{1}{2}$ 2

TSA   rl   r   where   slant height

Open cone

−   H

TSA $\frac{1}{2}$ circumference of the base   slant height

TSA $\frac{1}{2}$ 2

TSA   lwhere =slant height

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12.1.1 Calculate y, the height at which the cone should be cut. (3)

12.1.2 Next, determine the volume of the bowl as $y=4$ cm. Use $=3.14$. (3)

12.1.3 The art student wants to paint the outer surface of the bowl with enamel paint. The paint can be bought in 100 ml cans. If one can 90 cm$_2$deck, how many cans will he have to buy? (5)

12.2 The picture below shows paint spilled on a wall.

Below is a sketch representing the area covered by the paint.

5 m	5 m	5 m	5 m	5 m	5 m
7.4 m	6.9 m	5.6 m	7.8 m	6.7 m	7.4 m	8.1 m
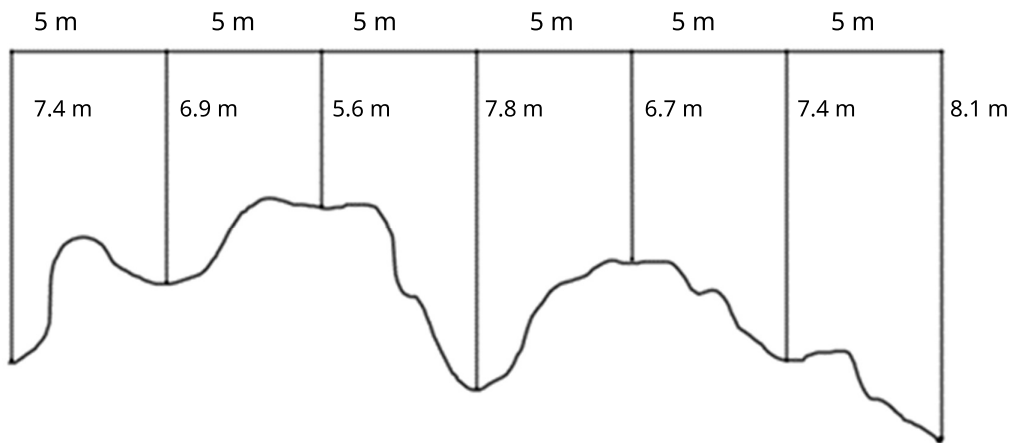
Use the center ordinate rule to calculate the area of the paint spilled.

(3)

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TOTAL: 150

INFORMATION SHEET: TECHNICAL MATHEMATICS

$\sqrt{}$

$\overline{2}$

$\dfrac{4}{4}$

$\Leftrightarrow$, 0, 1 0

1 1 1 1

1 — 1

$\lim\limits_{\to}\dfrac{h}{h}$

—— , , $\in \mathbb{R}$ with 1 and 0

– , 0 and $\mathbb{R}$; 0

—— , 0 ; 1 and , $\in \mathbb{R}$; 0

$\overline{}$

$\dfrac{}{2}$; $\dfrac{}{2}$

$\overline{}$

—— —— 1

In ΔABC: —— —— —— 2 .

ΔABC $\dfrac{1}{2}$.

sin θ cos θ 1 1 tan θ Sec θ cot θ 1 cosec

180°

Angular velocity | 2 | where a=rotation frequency

Angular velocity | 360 | where a=rotation frequency

Circumferential velocity | where D=midline and a=rotation frequency

Circumferential velocity | ωr | where =angular velocity and radius

Arc length | where r=radius and central angle in radians

Area of sector | $\overline{2}$ | where r=radius, s=arc length

$\overline{2}$ | where r=radius and central angle in radians

$4h$ $4h$ 0 | where h=height of segment, d=center line of circle and x=length of cord

… | where a=equal parts, —— ordinate and a=number of ordinates

OR

$\overline{2}$ … | where a=equal parts,   ordinate and n= number ordinate