

Student Name: \_\_\_\_\_

Teacher Initials: \_\_\_\_\_

ARM      ECB  
RDG      AHP  
AYH/LMD    JGD  
RAS\*      SJB  
DOB      JZT

**Friday, 19<sup>th</sup> August 2022**  
Period 2 or 4  
55 minutes  
260 copies

## Year 10

### 5.3 MATHEMATICS

### Assessment Task 3

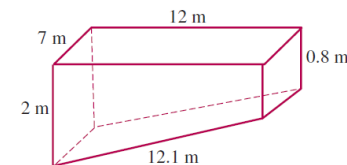
#### General Instructions

- Write your name in the spaces provided.
- Write using blue or black pen.
- Answer in the spaces provided.
- NESA approved calculators may be used.
- Show ALL necessary working.
- Marks may not be awarded for careless or poorly arranged working.
- Diagrams are NOT to scale.

Section	Marks
1. Surface Area and Volume	/ 15
2. Trigonometry	/ 16
3. Co-ordinate Geometry	/ 15
4. Mixed Problems	/ 8
<b>Total Marks:</b>	<b>/ 54</b>

#### Section 1: Surface Area and Volume (15 marks)

1. Kieran has the following trapezoidal swimming pool in his backyard.



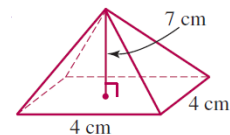
- i. Calculate the *volume* of the swimming pool. Round your answer to 1 decimal place.

2

- ii. The pool is filled to the brim. Over a long weekend it loses one third of its capacity due to evaporation. How many litres of water remain after the long weekend?

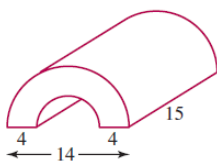
2

2. Find the *surface area* of the following square pyramid. Round your answer to 1 decimal place.



3. A sphere has a *surface area* of  $200 \text{ cm}^2$ . What is the size of its radius?  
Round your answer to 2 decimal places. 2

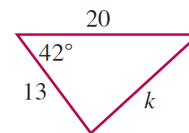
4. Find the *volume* of the following composite shape, leaving your answer in *exact form*.  
All measurements are in centimetres. 3



5. A brand of chocolate milk comes in cartons which are similar shapes. If the smaller carton has a height 15 cm and holds 324 mL, what is the capacity of the larger carton if its height is 20 cm? 3

## Section 2: Trigonometry (16 marks)

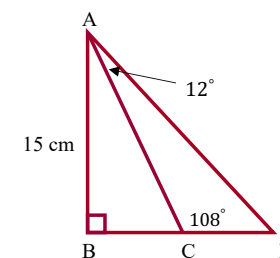
6. In the triangle below, find the value of  $k$ , rounded to 1 decimal place. All units are in centimetres. 2



7. In  $\triangle ABC$ ,  $\angle A = 32^\circ$ ,  $a = 11 \text{ cm}$  and  $b = 15 \text{ cm}$ . Find the two possible sizes of  $\angle B$ .  
Round your answers to the nearest minute. 3

8. Consider the triangles in the diagram to the right.

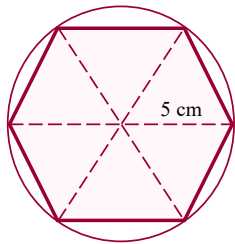
- i. Find the length of AC, to 2 decimal places. 2



- ii. Find the length of CD, to 2 decimal places. 2

9. A regular hexagon is inscribed within a circle with radius 5 cm.  
Find the area of the hexagon, rounded to 1 decimal place.

3



10. A hiker left base camp and walked 15 km on a bearing of  $70^\circ$  to a hill. She then travelled for 21 km in an approximately south easterly direction. She found herself 30 km from base camp.

- i. Draw a diagram of this scenario. Include all the information provided.

1

- ii. What is the hiker's bearing from base camp? Round to the nearest minute.

3

### Section 3: Co-ordinate Geometry (15 marks)

11. Find the length of the interval joining the points  $P(10, 8)$  and  $Q(2, -7)$ .

2

12. Find the gradient of the line that passes through  $R(8, 4)$  and  $S(-6, 5)$ .

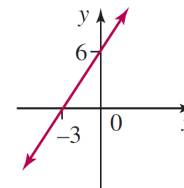
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13. The midpoint of the interval joining  $E(5, 12)$  and  $F(a, b)$  is  $(6, 2)$ .  
Determine the values of  $a$  and  $b$ .

2

14. Find the equation of the following line.

2



15. Find the equation of the line that:

a. is parallel to  $y = 3x - 5$  and passes through the point  $(4, -2)$ .

2

b. is perpendicular to  $4x - 3y - 6 = 0$  and passes through the point  $(1, 5)$ .

3

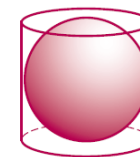
c. makes an angle of  $135^\circ$  with the positive direction of the  $x$ -axis and passes through the point  $(0, 8)$ .

2

#### Section 4: Mixed Problems (8 marks)

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16. A sphere lies within a cylinder such that it touches the ends and sides of the cylinder.

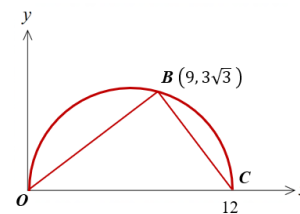


What fraction of the volume of the cylinder is taken up by the sphere?

2

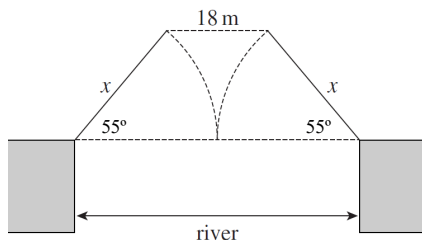
17.  $OBC$  is a semicircle with diameter  $OC$ . Show that  $OB \perp BC$ .

3



18. A bridge spans a river. When tall boats need to pass, two identical sections of the bridge, each of  $x$  metres in length, are raised.

When the two sections are fully raised, they create an angle of inclination of  $55^\circ$  to the horizontal and there is an 18 metre gap between them, as shown in the diagram.



Find the width of the river, to 1 decimal place.

3

END OF ASSESSMENT

# MR10 S.3 Student Solutions Copy Ass Task 3

## Question 1:

$$\begin{aligned} (i) \quad A &= \frac{1}{2}(12)(2+0.8) \\ A &= 6 \times 2.8 \\ A &= 16.8 \\ \therefore V &= Ah \\ V &= 16.8 \times 7 \\ V &= 117.6 \text{ m}^3 \end{aligned}$$

$$\begin{aligned} (ii) \quad \text{Capacity} &= (117.6 \times 1000) \\ &\quad \times \frac{2}{3} \\ &= 78400 \text{ L remain} \end{aligned}$$

## Question 2:

$$\begin{aligned} \text{Slant height (h)} \\ h^2 &= 2^2 + 7^2 \\ h^2 &= 53 \\ h &= \sqrt{53} \end{aligned}$$

$$\begin{aligned} SA &= (4 \times 4) + 4\left(\frac{1}{2} \times \sqrt{53} \times 4\right) \\ &= 74.2 \text{ cm}^2 \text{ (1dp)} \end{aligned}$$

## Question 3:

$$\begin{aligned} 4\pi r^2 &= 200 \\ \pi r^2 &= 50 \\ r^2 &= \frac{50}{\pi} \\ r &= \sqrt{\frac{50}{\pi}} \end{aligned}$$

$$\begin{aligned} r &\doteq 3.99 \text{ cm} \\ &\quad (2dp) \end{aligned}$$

## Question 4:

$$\begin{aligned} V &= \left[ \pi(7)^2 15 - \pi(3)^2 15 \right] \div 2 \\ &\quad (\text{Half pipe}) \\ V &= \left[ 15\pi(49-9) \right] \div 2 \\ V &= \frac{600\pi}{2} \text{ cm}^3 \\ V &= 300\pi \text{ cm}^3 \text{ (exact)} \end{aligned}$$

## Question 5:

$$\begin{aligned} \text{Ratio of} &= 15:20 \\ \text{Sides} &= 3:4 \end{aligned}$$

$$\begin{aligned} \text{Ratio of} &= 3^3:4^3 \\ \text{Volumes} &= 27:64 \end{aligned}$$

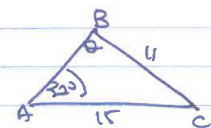
$$\begin{aligned} \therefore \frac{324}{x} &= \frac{27}{64} \\ 27x &= 20736 \\ x &= 768 \text{ ml} \end{aligned}$$

## TRIGONOMETRY

## Question 6:

$$\begin{aligned} K^2 &= (13)^2 + (20)^2 - 2(13)(20)\cos 42^\circ \\ K^2 &= 182.5646908 \dots \\ \therefore K &\doteq 13.5 \text{ cm (1dp)} \end{aligned}$$

## Question 7:



$$\frac{\sin \theta}{15} = \frac{\sin 30^\circ}{11}$$

$$\sin \theta = \frac{15 \sin 30^\circ}{11}$$

$$\sin \theta = 0.7226 (71715)$$

$$\theta = 46^\circ 16'$$

$$\text{or possibly } (180 - 46^\circ 16')$$

$$\theta = 133^\circ 44'$$

## Question 8:

$$(i) \angle AEB = 72^\circ \quad (\text{Suppl. Ls})$$

$$\therefore \frac{15}{x} = \sin 72^\circ$$

$$x = \frac{15}{\sin 72^\circ}$$

$$x \doteq 15.77 \text{ cm}$$

$$(ii) \text{ Let } CD = x$$

$$\text{and } \angle ADC = 60^\circ$$

$$\therefore \frac{x}{\sin 12^\circ} = \frac{15.77}{\sin 60^\circ}$$

$$x = \frac{\sin 12^\circ \times 15.77}{\sin 60^\circ}$$

$$x \doteq 3.79 \text{ cm} \quad (2dp)$$

Question 9:

Angles in Centre

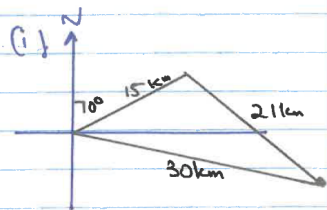
$$\frac{360}{6} = 60^\circ$$

$$A = 6 \times \left(\frac{1}{2}ab \sin C\right)$$

$$A = 6 \times \left(\frac{1}{2} \times 5 \times 5 \times \sin 60^\circ\right)$$

$$A = 65.0 \text{ cm}^2 \text{ (1dp)}$$

Question 10:



(note: travels an approximate south easterly direction (not SE).)

$$(11) \cos \theta = \frac{15^2 + 30^2 - 21^2}{2 \times 15 \times 30}$$

$$\cos \theta = \frac{689}{900}$$

$$\theta = \cos^{-1} \left( \frac{689}{900} \right)$$

$$\theta = 40.53^\circ \dots$$

$$\text{Bearing} = 70^\circ + 40^\circ 32'$$

$$= 110^\circ 32'$$

Co-ordinate Geometry

Question 11:

$$d = \sqrt{(2-10)^2 + (-7-8)^2}$$

$$d = \sqrt{64 + 225}$$

$$d = \sqrt{289}$$

$$d = 17$$

Question 12:

$$m = \frac{5-4}{-6-8}$$

$$m = -\frac{1}{14}$$

Question 13:

$$M = (6, 2)$$

$$\therefore (6, 2) = \left( \frac{a+5}{2}, \frac{b+12}{2} \right)$$

$$\therefore \frac{a+5}{2} = 6 \quad \frac{b+12}{2} = 2$$

$$a+5 = 12 \quad b+12 = 4$$

$$a = 7 \quad b = -8$$

$$\therefore a = 7 \quad b = -8$$

Question 14:

$$y = mx + b$$

$$y = \frac{6}{3}x + 6$$

$$y = 2x + 6$$

$$\text{or } 2x - y + 6 = 0$$

Question 15:

$$(a) \quad M_1 = M_2$$

$$\therefore M_2 = 3$$

$$y - y_1 = m(x - x_1)$$

$$y - (-2) = 3(x - 4)$$

$$y + 2 = 3x - 12$$

$$\therefore y = 3x - 14$$

$$(b) \quad M_1 M_2 = -1$$

$$\frac{4}{3} \times M_2 = -1$$

$$\therefore M_2 = -3/4$$

Note

$$4x - 3y - 6 = 0$$

$$3y = 4x - 6$$

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

$$\therefore M_1 = 4/3$$

$$\therefore 4 - 5 = -3/4(x - 1)$$

$$4y - 20 = -3(x - 1)$$

$$4y - 20 = -3x + 3$$

$$\therefore 3x + 4y - 23 = 0$$

$$(c) \quad m = \tan \theta$$

$$\therefore m = \tan 135^\circ$$

$$m = -1$$

$$y - 8 = -1(x - 8)$$

$$y - 8 = -x$$

$$\therefore x + y - 8 = 0$$

$$\text{or } y = -x + 8$$

Section 4: Mixed

Question 16:

$$V = \pi r^2 h; \quad V = \frac{4}{3} \pi r^3$$

$$h = 2r$$

Cylinder

$$V = \pi r^2 2r$$

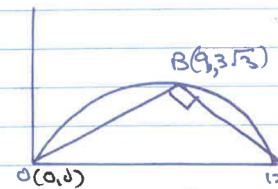
$$V = 2\pi r^3$$



$$\text{So } \frac{\frac{4}{3} \pi r^3}{2 \pi r^3} = \frac{4}{3} \div 2$$

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

Question 17:



$$\text{Gradient OB} = \frac{3\sqrt{3}-0}{9-0}$$

$$= \frac{3\sqrt{3}}{9}$$

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

$$\text{Gradient BC} = \frac{3\sqrt{3}-0}{9-12}$$

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

$$= -\sqrt{3}$$

$$\therefore M_1 \times M_2 = -1 \text{ (Perpendicular)}$$

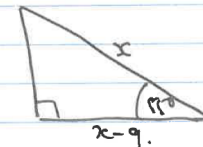
$$\therefore M_1 \times M_2 = \frac{\sqrt{3}}{3} \times -\frac{\sqrt{3}}{1}$$

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

$$= -1$$

$$\therefore OB \perp BC.$$

Question 18:



$$\therefore \frac{x-9}{x} = \cos 55^\circ$$

$$x-9 = x \cos 55^\circ$$

$$\therefore x \cos 55^\circ - x = -9$$

$$x (\cos 55^\circ - 1) = -9$$

$$x = \frac{-9}{\cos 55^\circ - 1}$$

$$x = 21.1 \text{ m.}$$

$$\text{Width} = 2x$$

$$= 42.2 \text{ m.}$$

END.