

# MATHEMATICS METHODS

## YEAR 11 UNIT 1

### TEST 1

2021



#### Section 1

NON CALCULATOR

REVISION PAPER

TIME: 30 mins

MARKS: 40 marks

STUDENT'S NAME: \_\_\_\_\_

*Solutions.*

CIRCLE YOUR

TEACHER'S NAME:

Mrs Kalotay

Ms Leow

Mr Riemer

Mrs Scoles

Ms Thompson

Ms Tsen

Mr Whiteley

- Show all necessary working in order to obtain full marks.
- A formula sheet will be provided.

# Question 1

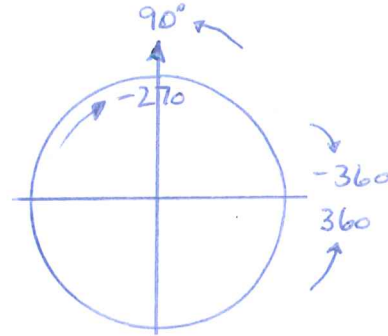
(9 marks)

(a) Determine all possible values over the given domain, for each of the following.

(i)  $\sin(\theta) = 1$   $-360^\circ \leq \theta \leq 360^\circ$

(1 mark)

$$\theta = 90^\circ \text{ or } 270^\circ$$

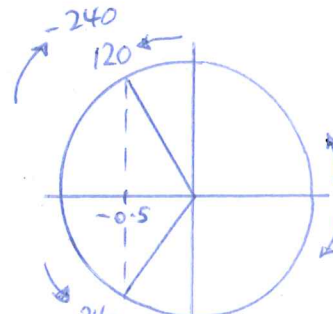


(ii)  $\cos(\theta) = -0.5$   $-360^\circ \leq \theta \leq 360^\circ$

(2 marks)

$$\theta = 120^\circ, 240^\circ \checkmark$$

$$= -120^\circ, -240^\circ \checkmark$$

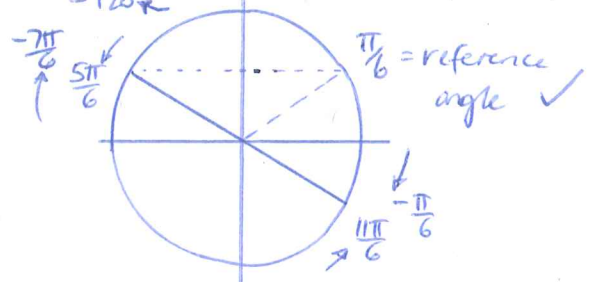


(iii)  $\tan(\theta) = -\frac{1}{\sqrt{3}}$   $-2\pi \leq \theta \leq 2\pi$

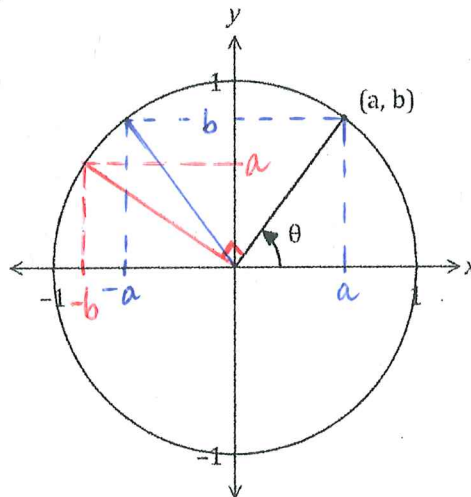
(3 marks)

$$\theta = \frac{5\pi}{6}, \frac{11\pi}{6} \checkmark$$

$$= -\frac{\pi}{6}, -\frac{7\pi}{6} \checkmark$$



(b) Using the unit circle shown, determine the following in terms of  $a$  and/or  $b$ , given that  $\theta$  is an acute angle measured in degrees.



(i)  $\sin(\theta) = b$

(1 mark)

(ii)  $\cos(180 - \theta) = -a$

(1 mark)

(iii)  $\tan(90 + \theta) = -\frac{a}{b}$

(1 mark)

**Question 3****(9 marks)**

Consider the following two graphs, A and B.

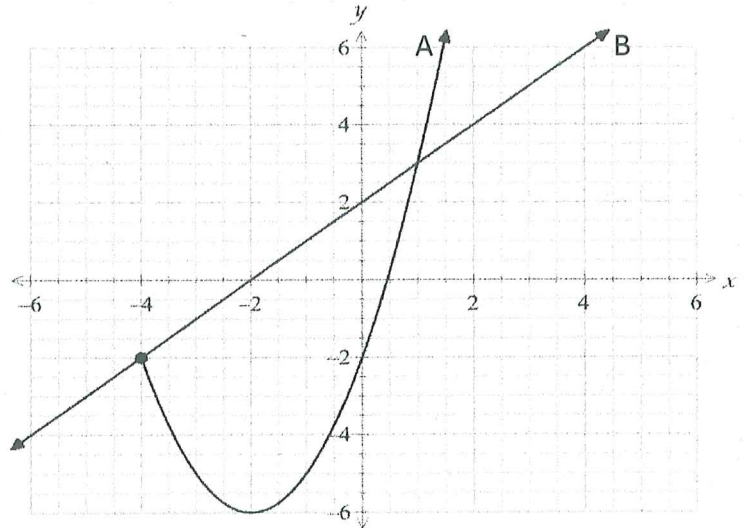
(a) For the graph of A, state

(i) the domain. (1 mark)

$$\{x \in \mathbb{R} : x \geq -4\}$$

(ii) the range. (1 mark)

$$\{y \in \mathbb{R} : y \geq -6\}$$



(b) For the graph of B, state

(i) its equation

(1 mark)

$$y = x + 2.$$

(ii) the angle of inclination and show how it can be derived from the equation.

(2 marks)

gradient of  $y = x + 2$  is 1.

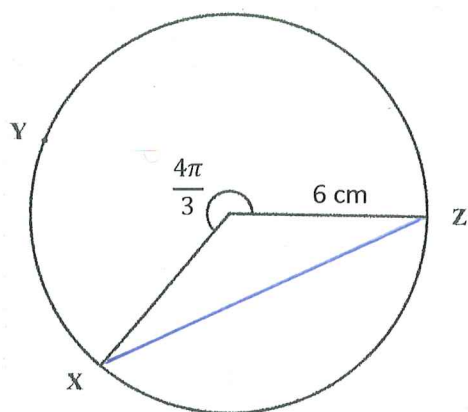
$$\therefore \tan \theta = 1$$

$$\therefore \theta = 45^\circ.$$

Question 5

(5 marks)

Consider the following circle with a radius of 6 cm and a central angle of  $\frac{4\pi}{3}$ .



Find the length of the following as an exact value in its simplest form.

(a) The major arc XYZ.

(2 marks)

$$\begin{aligned} \text{Arc length} &= 6 \times \frac{4\pi}{3} \\ &= 8\pi \text{ cm} \end{aligned}$$

(b) The chord XZ.

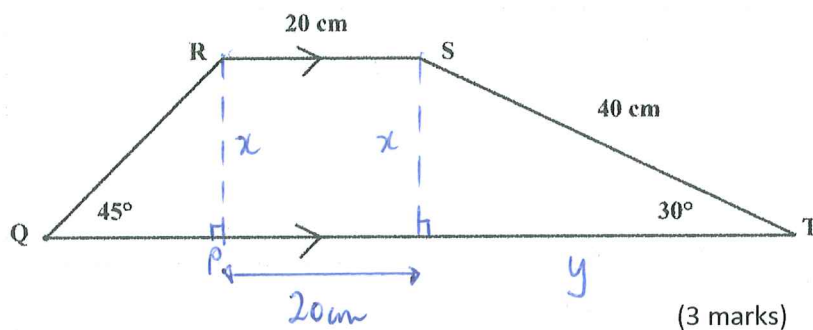
(3 marks)

$$\begin{aligned} \text{chord} &= 2(6) \sin\left(\frac{1}{2} \times \frac{4\pi}{3}\right) \\ &= 12 \sin \frac{2\pi}{3} \\ &= 12 \times \frac{\sqrt{3}}{2} \\ &= 6\sqrt{3} \text{ cm.} \end{aligned}$$

Question 6

(9 marks)

Consider the trapezium  $QRST$  shown below, with  $\angle Q = 45^\circ$ ,  $\angle T = 30^\circ$ ,  $RS = 20 \text{ cm}$  and  $ST = 40 \text{ cm}$ .



(a) Determine the exact length of

(i)  $QR$

(3 marks)

$$\sin 30 = \frac{x}{40}$$

$$\frac{1}{2} = \frac{x}{40}$$

$$20 = x \quad \checkmark$$

$$\sin 45 = \frac{x}{QR} \quad \checkmark$$

$$\frac{1}{\sqrt{2}} = \frac{x}{QR}$$

$$QR = x\sqrt{2}$$

$$= 20\sqrt{2} \text{ cm} \quad \checkmark$$

(ii)  $QT$

(3 marks)

$$QP = RP$$

$$\therefore QP = 20 \text{ cm.}$$

$$\cos 30 = \frac{y}{40} \quad \checkmark$$

$$\frac{\sqrt{3}}{2} = \frac{y}{40}$$

$$y = 20\sqrt{3} \quad \checkmark$$

$$\therefore QT = (40 + 20\sqrt{3}) \text{ cm} \quad \checkmark$$

(b) Show that the exact area of the trapezium is,  $200(3 + \sqrt{3}) \text{ cm}^2$ .

(3 marks)

$$\text{Area} = \frac{1}{2} (20 + 40 + 20\sqrt{3}) \times 20 \quad \checkmark$$

$$= 10 (60 + 20\sqrt{3}) \quad \checkmark$$

$$= 10 \times 20 (3 + \sqrt{3}) \quad \checkmark$$

$$= 200 (3 + \sqrt{3}) \text{ cm}^2.$$

**1. (1, 2, 2, = 5 Marks)**

(a) Complete the next row of Pascal's Triangle.

				1					Row 0
				1	1				Row 1
			1	2	1				Row 2
		1	3	3	1				Row 3
	1	4	6	4	1				Row 4
	1	5	10	10	5	1			Row 5
→	1	6	15	20	15	6	1		Row 6
	1	7	21	35	35	21	7	1	Row 7
	1	8	28	56	70	56	28	8	Row 8

Use Pascal's Triangle to answer the following questions.

(b) Expand and simplify  $(x - 2)^6$ .

$$= x^6 - 12x^5 + 60x^4 - 160x^3 + 240x^2 - 192x + 64$$

coefficients ✓  
all correct ✓

(c) Factorise  $a^5 - 5a^4b + 10a^3b^2 - 10a^2b^3 + 5ab^4 - b^5$ .

$$(a-b)^5$$

# MATHEMATICS METHODS

## YEAR 11 UNIT 1

### TEST 1

2021



### Section 2

CALCULATOR ASSUMED

TIME: 20 mins  
MARKS: 20 marks

STUDENT'S NAME: Solutions.

CIRCLE YOUR  
TEACHER'S NAME:

Mrs Kalotay

Ms Leow

Mr Riemer

Mrs Scoles

Ms Thompson

Ms Tsen

Mr Whiteley

- Show all necessary working in order to obtain full marks as marks will be allocated for specific working.
- A formula sheet will be provided.
- One single sided A4 page of notes is permitted



Question 7

→ Not Part of Test 1.

(4 marks)

A metallurgist calculates that the length ( $L$ ) of a metal rod is dependent on the temperature ( $t$ ) of the metal. She found that at  $10^{\circ}\text{C}$  the metal rod was 15.2 metres long, but at  $20^{\circ}\text{C}$  it was 15.3 metres.

(a) Determine an equation for the length of the metal rod, given its temperature. (2 marks)

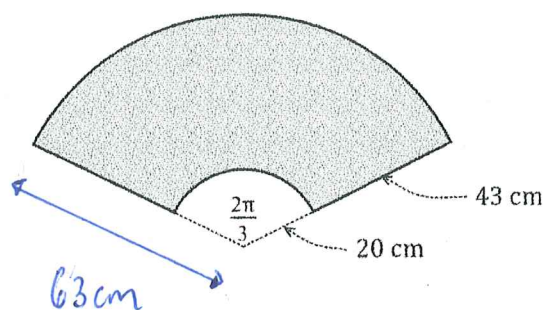
(b) The metallurgist recorded the length of the metal rod to be 30.6 metres at  $40^{\circ}\text{C}$ . Show that this length was recorded incorrectly. (1 mark)

(c) Determine with reasoning, if this situation is an example of direct proportion. (1 mark)

Question 8

(3 marks)

A windscreen wiper on a car is 43 cm long and rotates through one-third of a circle with the radii of the inner arc being 20 cm, as shown below. Determine the area of the shaded region.



$$\begin{aligned} \text{Area}_1 &= \frac{1}{2} (43)^2 \times \frac{2\pi}{3} \quad \checkmark \\ &= 4156.33 \end{aligned}$$

$$\begin{aligned} \text{Area}_2 &= \frac{1}{2} (20)^2 \times \frac{2\pi}{3} \\ &= 418.88 \quad \checkmark \end{aligned}$$

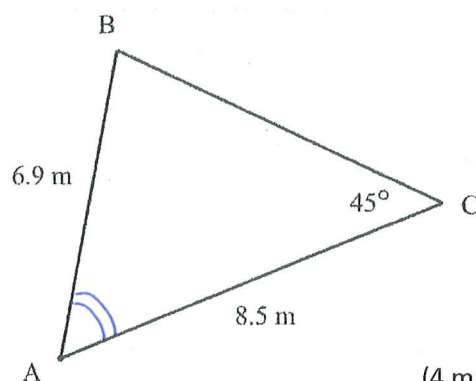
$$\begin{aligned} \text{Shaded Area} &= 4156.33 - 418.88 \\ &= 3737.45 \text{ cm}^2 \quad \checkmark \end{aligned}$$



Question 9

(6 marks)

Consider  $\triangle ABC$  with  $AC = 8.5$  m,  $AB = 6.9$  m and  $\angle ACB = 45^\circ$ , as shown below.



- (a) Determine the size of  $\angle BAC$ .

(4 marks)

$$\frac{\sin B}{8.5} = \frac{\sin 45}{6.9} \quad \checkmark$$

$$\angle B = 60.58^\circ \quad \text{or} \quad \angle B = 119.42^\circ \quad \checkmark$$

$$\begin{aligned} \angle A &= 180 - 45 - 60.58 \\ &= 74.42^\circ \quad \checkmark \end{aligned}$$

$$\begin{aligned} \angle A &= 180 - 45 - 119.42 \\ &= 15.58^\circ \quad \checkmark \end{aligned}$$

- (b) Determine the possible values for the area of  $\triangle ABC$ .

(2 marks)

$$\begin{aligned} \text{Area} &= \frac{1}{2} (6.9)(8.5) \sin 74.42^\circ \\ &= 28.25 \text{ m}^2 \quad \checkmark \end{aligned}$$

or

$$\begin{aligned} \text{Area} &= \frac{1}{2} (6.9)(8.5) \sin 15.58^\circ \\ &= 7.88 \text{ m}^2 \quad \checkmark \end{aligned}$$

## Question 10

(7 marks)

- (a) Find the size of the acute angle between the lines  $5x - 3y = 4$  and  $y - 3x = -6$ . (4 marks)

$$5x - 3y = 4$$

$$-3y = -5x + 4$$

$$y = \frac{5}{3}x - \frac{4}{3} \quad \checkmark$$

$$\therefore \tan \theta = \frac{5}{3}$$

$$\theta = 59.04^\circ \quad \checkmark$$

$$y - 3x = -6$$

$$y = 3x - 6$$

$$\tan \theta = 3$$

$$\theta = 71.57^\circ \quad \checkmark$$

The angle between the lines is  $= 12.53^\circ \quad \checkmark$

- (b) A third line intersects the line  $y - 3x = -6$ , at an angle of  $50^\circ$ . If all three lines intersect at the same point, determine an equation for the third line. (3 marks)

Point of intersection (from classpad)  $= (3.5, 4.5) \quad \checkmark$

Angle of inclination for  $y - 3x = -6 = 71.57^\circ$ .

Angle of inclination for new line  $= 71.57 + 50$  or  $71.57 - 50$   
 $= 121.57$  or  $21.57$

$$\therefore \tan 121.57 = -1.63 \quad \checkmark \quad \text{or} \quad \tan 21.57 = 0.395 \quad \checkmark$$

$$y = -1.63x + c$$

$$4.5 = -1.63(3.5) + c$$

$$c = 10.20$$

$$y = 0.40x + c$$

$$4.5 = 0.40(3.5) + c$$

$$c = 3.12$$

$$y = -1.63x + 10.20 \quad \checkmark$$

END OF TEST

OR

$$y = 0.40x + 3.12 \quad \checkmark$$

7. (2, 2, 2 = 6 Marks)

Some patients in a speech clinic are nominated for a special training programme. They fall into the following categories

	4 years and under	Between 4 and 12 years	12 years and over
Hearing Impaired	6	12	8
Hearing Un-Impaired	8	7	7

6 Patients are to be selected.

How many different selections are possible if:-

(a) There must be two from each age group.

$$\binom{14}{2} \binom{19}{2} \binom{15}{2} = 1\,633\,905 \quad \checkmark$$

(b) The programme is suitable only for children under 12 years of age.

$$\binom{33}{6} \quad \checkmark = 1\,107\,568 \quad \checkmark$$

(c) Irrespective of age, there must be equal numbers of hearing impaired and hearing-unimpaired subjects.

$$\binom{26}{3} \binom{22}{3} \quad \checkmark = 4\,004\,000 \quad \checkmark$$

END OF TEST