MATHEMATICS METHODS : UNITS 1 & 2, 2020
Test 1 – (10%)
1.2.1 – 1.2.8

Time Allowed	First Name	Surname	Marks
45 minutes			43/~~44~~ marks

Circle your Teacher's Name:

Benko	Bestall	Fraser-Jones	Goh
Koulianos	Luzuk	Rudland	Tanday

Assessment Conditions: *(N.B. Sufficient working out **including diagrams** must be shown to gain full marks)*

❖ Calculators: Allowed

❖ Formula Sheet: Provided

❖ Notes: Not Allowed

Question 1

(1, 1, 1 & 1 = 4 marks)
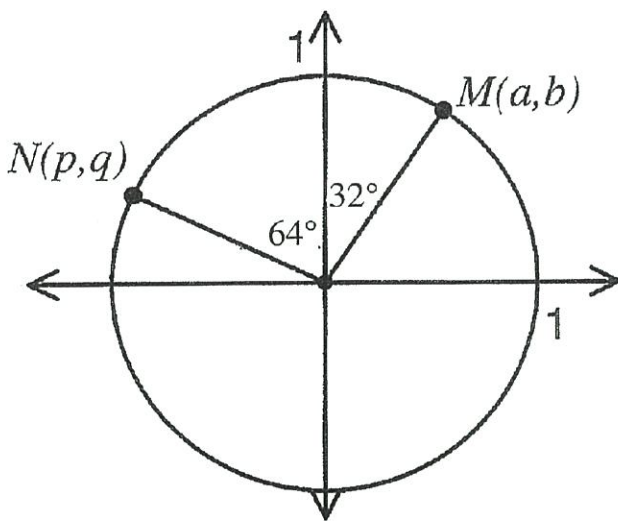
Two points *N(p,q)* and *M(a,b)* are plotted on the unit circle above.
In terms of *a, b, p and/or q,* determine the following.

    i) $\sin 26° = q$ ✓

    ii) $\cos 154° = p$ ✓

    iii) $\cos 26° = -p$ ✓

    iv) $\tan 122° = \dfrac{-b}{a}$ ✓

④ R/W

Question 2

(2, 2 = 4 marks)

(a) Express the following angles in radians. Answers should be simplified, in exact values and in terms of π.

(i) 45°

$$\frac{\pi}{4} \checkmark$$

(ii) 160°

$$\frac{8\pi}{9} \checkmark$$

(b) Express the following angles in degrees.

(i) $\frac{3\pi}{5}$ radians

$$108° \checkmark$$

(ii) 2.2 radians (round to nearest degree)

$$126° \checkmark$$
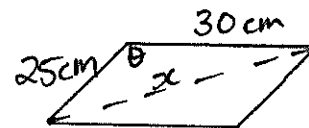
④

R/W

Question 3

(5 marks)

A parallelogram has side lengths of 25 and 30 cm and an area of 700cm². Find the length of the longest diagonal.

$\checkmark$ use 350 & area $\triangle$

$$350 = \tfrac{1}{2} \times 30 \times 25 \times \sin\theta$$

$$\theta = 69° \checkmark \text{ or } 111° \checkmark$$

since largest diagonal $\theta = 111°$ $\checkmark$ uses $111°$ (largest angle)

$$x^2 = 25^2 + 30^2 - 2 \times 25 \times 30 \cos 111°$$
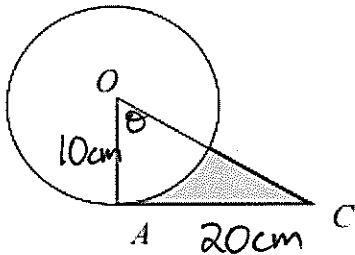
$$x = 45.4 \text{ cm} \checkmark$$

max $\tfrac{3}{5}$ if uses 69°

⑤

Question 4

(4 marks)

Triangle *ACO* is a right angled triangle with *OA* = 10cm, *AC* = 20cm and the size of angle *OAC* = 90°. A circle of radius 10cm is drawn, centre *O*. Find the area of that part of the triangle *OAC* not lying in the circle.

$$A(Tri) = \frac{1}{2} \, 10 \times 20$$
$$= 100 \, cm^2 \checkmark$$

$$\tan\theta = \frac{20}{10}$$
$$\theta = 1 \cdot 1^R \checkmark$$

$$A(Sector) = \frac{1}{2} \, 10^2 \times 1 \cdot 1^R$$
$$= 55 \cdot 4 \checkmark$$

$$A(Outside) = 100 - 55 \cdot 4$$
$$= 44 \cdot 6 \, cm^2 \checkmark$$

④

Question 5

(4 marks)

Points *A* and *B* lie on the circumference of a circle with centre *O* and radius 12cm. If the major arc *AB* has a length of 60cm, find the area of the minor sector *AOB*.
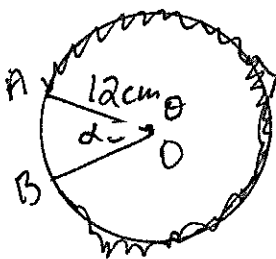
$$\ell = r\theta$$
$$60 = 12\theta$$
$$\theta = 5^R \checkmark$$

✓ recognises need to find reflex.

angle minor arc $\alpha = 2\pi - 5$
$$= 1 \cdot 28^R \checkmark$$

$$A(minor \ sector) = \frac{1}{2} \times 12^2 \times 1 \cdot 28$$

max $\frac{3}{4}$ if find major sector.
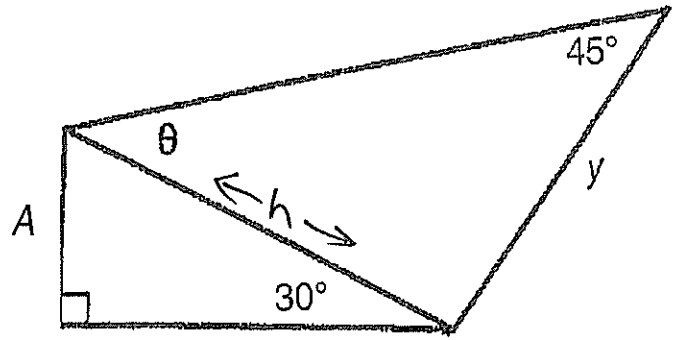
$$= 92 \cdot 4 \, cm^2 \checkmark \quad ④$$

Question 6

(4 marks)

For the diagram on the right show that

$$y = 2\sqrt{2}\ A\sin\theta$$

$$\sin 30° = \frac{A}{h} \quad \checkmark \quad \text{uses trig ratio to relate } A \& h$$

$$h = 2A \quad \checkmark \quad \text{simplifies correctly to get an expression for hypotenuse.}$$

$$\frac{y}{\sin\theta} = \frac{2A}{\sin 45} \quad \checkmark \quad \text{uses sine rule to relate } y, A \& \theta$$

$$y = \frac{2A}{\frac{1}{\sqrt{2}}} \sin\theta$$

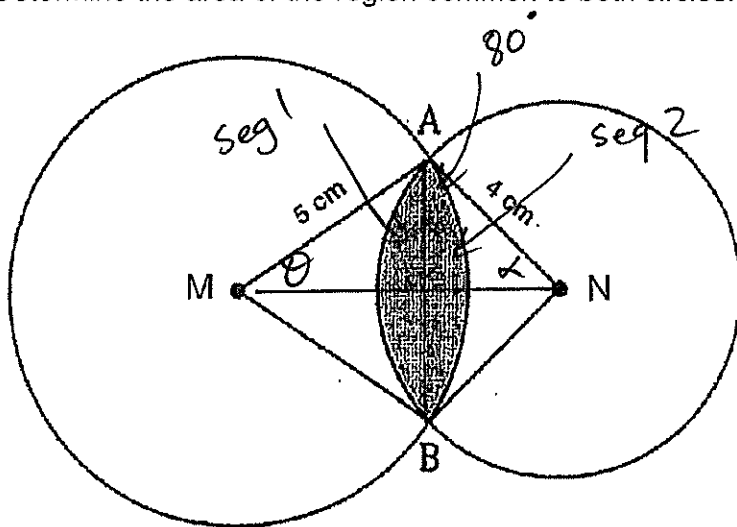$$\checkmark \quad \text{simplifies correctly.}$$

$$y = 2\sqrt{2}\ A\sin\theta$$

④

Question 7

(6 marks)

The diagram below shows two overlapping circles of radii 4 cm and 5 cm with the size of angle *MAN* is 80°. Determine the area of the region common to both circles.

$$MN^2 = 4^2 + 5^2 - 2 \times 4 \times 5 \cos 80°$$

$MN = 5.8 \text{ cm}$ ✓ calculates side (*If using geometry give this mark to both angles correct*)

$$\alpha^2 = 5^2 + 5.8^2 - 2 \times 5 \times 5.8 \cos \theta$$

$\theta = 0.74^R$ ✓

$2\theta = 1.48^R$

$\alpha = 1.00^R$ ✓ calculate correct angles

$2\alpha = 2.00^R$

$$A(\text{seg } 1) = \tfrac{1}{2} \times 5^2 (1.4.8 - \sin 1.48)$$
$$= 6.07 \quad ✓ \text{ calculates } A(\text{seg } 1)$$

$$A(\text{seg } 2) = \tfrac{1}{2} 4^2 (2 - \sin 2)$$
$$= 8.8 \quad ✓ \text{ calculates } A(\text{seg } 2)$$

∴ Total area 14.9 cm^2 ✓ Calculates shaded region.

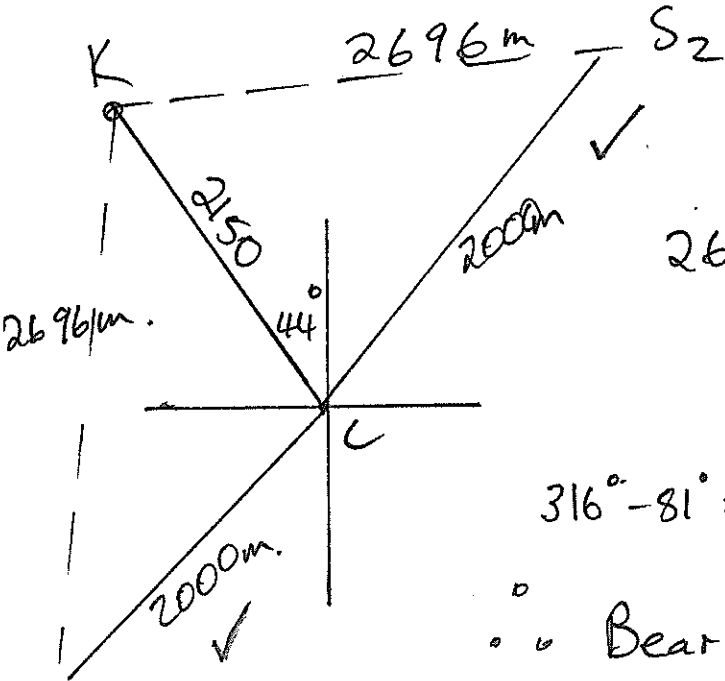* Can use geometry mode to find angles

* −1 if area units not given in answer.

(6)

Question 8

(6 marks)

Ken and Sofia set out in different directions from their campsite. Ken walks 2150m
on a bearing of 316°, whilst Sofia walks for 2000m on an unknown bearing. When they finish walking the
distance between them is 2696m. What are the possible bearings that Sofia could have used?

$2696^2 = 2000^2 + 2150^2 - 2000 \times 2150 \times$

✓ shows uses cos rule

$\cos \theta$

$\theta = 80.9°$ ✓ correct angle.

$316° - 81° = 235°$ or $316° + 81° = 397°$

∴ Bearing is $37°$ or $235°$

✓ ✓

f/t uses angle to find 2 bearings

represents 2 possible triangles
1 mark each.

max $\dfrac{4}{6}$ if only one triangle/bearing given.

⑥

Question 9

(6 marks)

A tanker, truck A, is loaded with petrol however receives a tyre puncture. Another tanker that is empty, truck B, is sent to be loaded with all the petrol from the tank of truck A. Both trucks have cylindrical tanks.
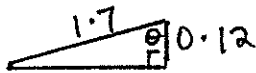
Truck A has a tank of radius 1.7 m and a length of 6 m. The tank is filled with petrol to a height of 1.58 m.

Truck B has the same length but a radius of 1.5m.
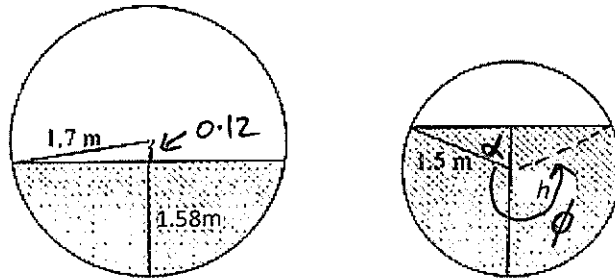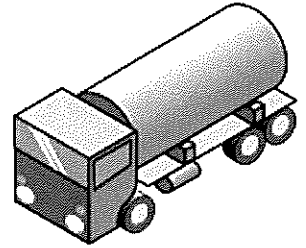
Circular ends of the petrol tanks.

The drivers are concerned as Truck B has a smaller tank. How high (h) will the petrol reach in the tank of Truck B?

$$\cos\theta = \frac{0.12}{1.7}$$

$$\theta = 1.5^r \checkmark$$

$$2\theta = 3.0$$

Truck A

$$A(segment) = \tfrac{1}{2} \times 1.7^2 (3 - \sin 3)$$
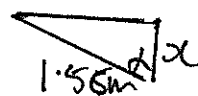
$$= 4.132 \checkmark$$

Truck B

$$4.132 = \tfrac{1}{2} \times 1.5^2 (\phi - \sin\phi)$$

$$\phi = 3.41 \checkmark$$

$$2\pi - 3.41 = 2.87$$

$$\alpha = \frac{2.87}{2}$$

$$= 1.44 \checkmark$$

$$\cos 1.44 = \frac{x}{1.5}$$

$$x = 0.1998 \checkmark$$

$$\therefore \text{height } 1.5 + 0.2 = \underline{\underline{1.7 \text{ m}}}$$

⑥