Manjimup SHS 2015

Year 11 Mathematics Methods Test 1

Trigonometry, Radian Measure & Functions

Name: ANSWERS

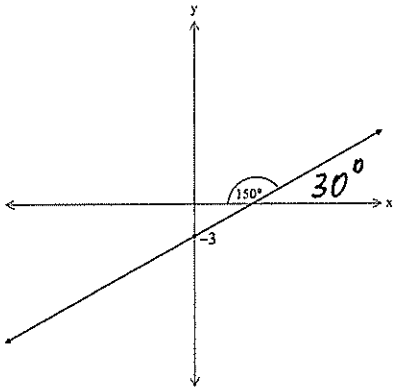
Score: _____ out of 32

Calculator Section (Calculators and 1 page (A4) of notes permitted, formula sheet provided)

Time: 40 minutes **Marks: 32 marks**

Question 5 [2 marks]

Determine the equation of the linear function shown below. All values should be expressed in exact form.



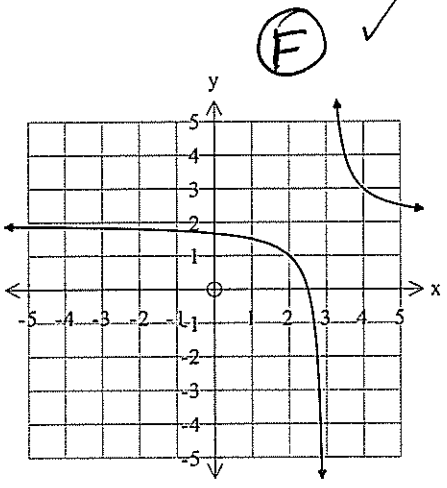
$m = \tan 30^\circ$

$m = \frac{1}{\sqrt{3}}$ ✓ correct gradient

$\Rightarrow y = \frac{1}{\sqrt{3}}x - 3$ ✓ correct rule

Question 6 [5 marks]

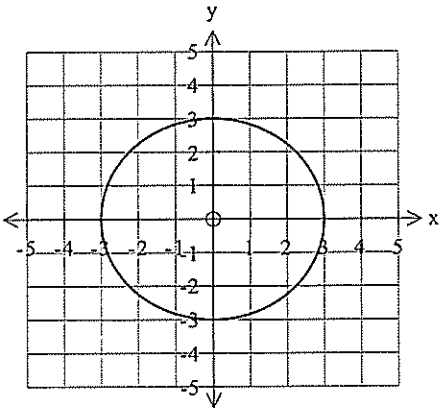
Indicate which of the following represent functions with the letter **F**. For those that are functions, state the natural domain and corresponding range.



F ✓

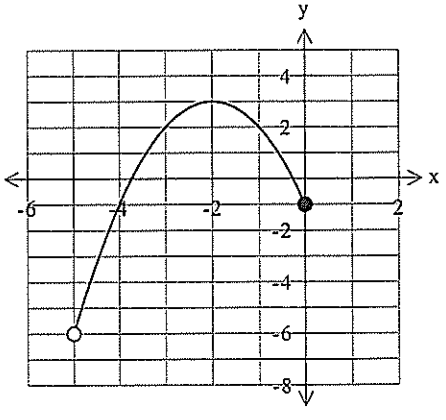
$x \in R, x \neq 3$ ✓

$y \in R, y \neq 2$



✓

1 off - incorrect domain/range.



F ✓

$-5 < x \leq 0$ ✓

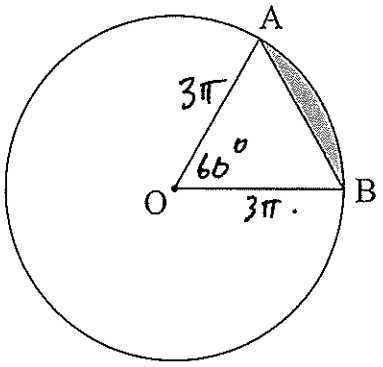
$-6 < y \leq 3$

RS

Question 7 **[8 marks]**

The circle shown with centre O has a radius of 3π cm.

If the size of $\angle AOB = 60°$, determine the



(a) area of triangle AOB as an **exact** value in terms of π.

$A = \frac{1}{2}.(3\pi)^2 \sin 60^\circ$ ✓

$= \frac{9\sqrt{3}\,\pi^2}{4}$ ✓

(2 marks)

(b) length of the ***major*** arc AB accurate to 2 decimal places.

$l = r\theta$

$= (3\pi)\left(\frac{5\pi}{3}\right)$ ✓

$= 49.35\text{cm}$ ✓

$300^\circ = 2\pi - \frac{\pi}{3}$

$= \frac{5\pi}{3}$.

1 off incorrect accuracy.

(2 marks)

(c) area of the ***minor*** sector AOB to the nearest cm^2.

$A = \frac{1}{2}(3\pi)^2 \frac{\pi}{3}$ ✓ $= 46.5\text{cm}^2$

$= 47.\text{cm}^2$. ✓

(2 marks)

(d) area of the ***minor*** segment (shaded) formed by the chord AB accurate to 3 significant figures.

$A = \frac{1}{2}(3\pi)^2\left[\frac{\pi}{3} - \sin\frac{\pi}{3}\right]$ ✓

$= 45.7\text{cm}^2$.

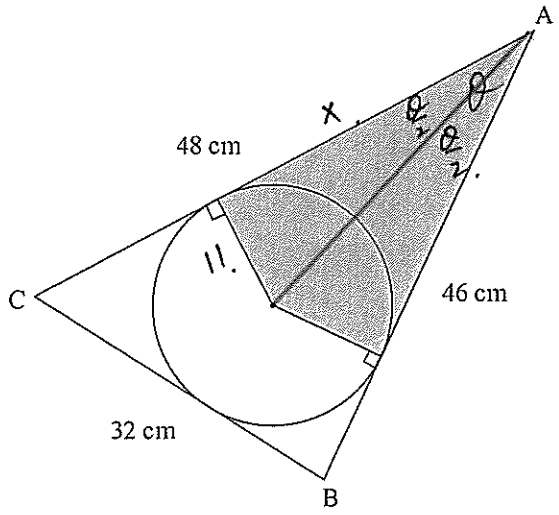
8.06cm^2. ✓

No deduction for s.f incorrect.

(2 marks)

Question 8 [5 marks]

Triangle ABC drawn below has sides of 32 cm, 46 cm and 48 cm. The circle with a radius of 11 cm is inscribed inside the circle and just touches the three sides of the triangle.



Note: Diagram not drawn to scale.

Determine the area of the shaded region. (Hint: First find the size of ∠BAC).

$$\cos\theta = \frac{48^2 + 46^2 - 32^2}{2(48)(46)}$$

$$\Rightarrow \theta = 39.73^\circ \quad \checkmark$$

$$\tan\frac{\theta}{2} = \frac{11}{x}$$

$$\Rightarrow x = \frac{11}{\tan\frac{\theta}{2}} \quad \checkmark$$

$$= \frac{11}{\tan 19.867^\circ}$$

$$x = 30.442 \quad \checkmark$$

Area one triangle

$$= \frac{1}{2}(11)(30.442)$$

$$= 167.43 \quad \checkmark$$

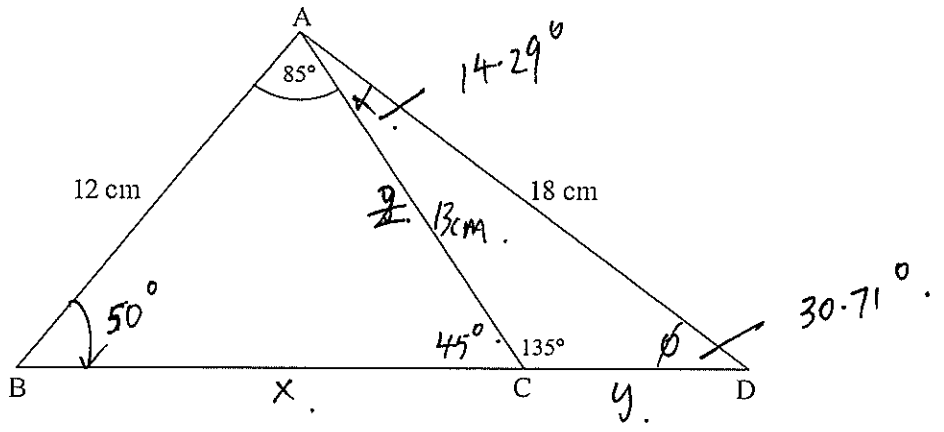
$\Rightarrow$ Shaded Area

$$= 334.86$$

$$\approx 334.9\ \text{cm}^2 \quad \checkmark$$

Question 9 **[6 marks]**

Determine, correct to 2 decimal places, the length of side BD in the diagram below.



Note: Diagram not drawn to scale.

$$\frac{x}{\sin 85^\circ} = \frac{12}{\sin 45^\circ} \checkmark \checkmark$$

$$\Rightarrow x = 16.906 \text{ cm}.$$

$$\frac{y}{\sin 14.29^\circ} = \frac{18}{\sin 135^\circ}$$

$$\Rightarrow y = 6.283. \checkmark$$

$$\frac{\not{x}}{\sin 50^\circ} = \frac{12}{\sin 45^\circ}$$

$$\Rightarrow \not{x} = 13 \text{ cm}. \checkmark$$

$$\frac{\sin \phi}{13} = \frac{\sin 135^\circ}{18}$$

$$\Rightarrow \phi = 30.71^\circ.$$

$$\Rightarrow \alpha = 14.29^\circ. \checkmark$$

$$\therefore \overline{BD} = 6.283 + 16.906$$

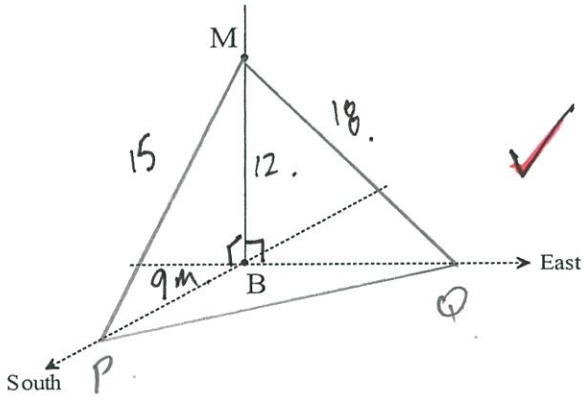
$$\boxed{\overline{BD} = 23.19 \text{ cm}.}$$

$\checkmark$.

Question 10 [6 marks]

A radio mast is supported by two wires MP and MQ each attached to point M which is 12 metres from the base B of the mast. B, Q and P are all on level ground with Q due East of the mast and P due South of the mast.

If MP = 15 metres and MQ = 18 metres, determine the angle between the wires i.e. find ∠QMP.



$\overline{PB}^2 = 15^2 - 12^2$

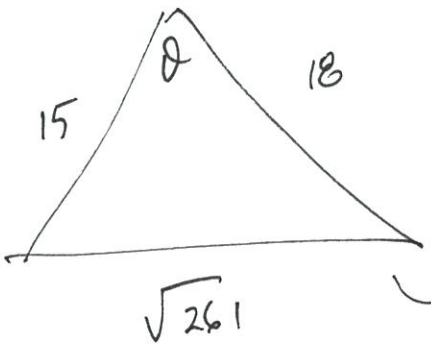
$\Rightarrow \overline{PB} = 9m.$

$\overline{QB}^2 = 18^2 - 12^2$

$= \sqrt{180}\ m.$

$\Rightarrow \overline{PB} = 9^2 + (\sqrt{180})^2$

$= \sqrt{261}\ m.$



$\cos\theta = \dfrac{15^2 + 18^2 - (\sqrt{261})^2}{2(15)(18)}$

$\Rightarrow \boxed{\theta = 57.8^0.}$

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Year 11 Mathematics Methods
Test 1

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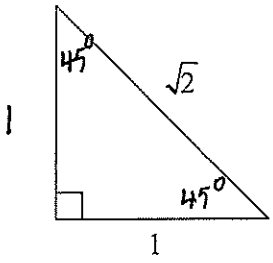
Score: _____ out of 20

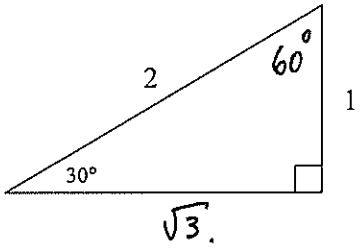
Non Calculator Section (No calculator or notes, formula sheet provided)

Time: 20 minutes **Marks: 20 marks**

Question 1 [5 marks]

Consider the two right triangles shown below.





(a) Complete each triangle i.e. determine all the missing sides and angles. Write your answers on the diagrams above.

(1 mark)

(b) Use your triangles to help you determine the **exact** value of

(i) $\sin 150°$ $= \sin 30° = \frac{1}{2}$

(ii) $\cos 225° = -\cos 45° = -\frac{1}{\sqrt{2}}$

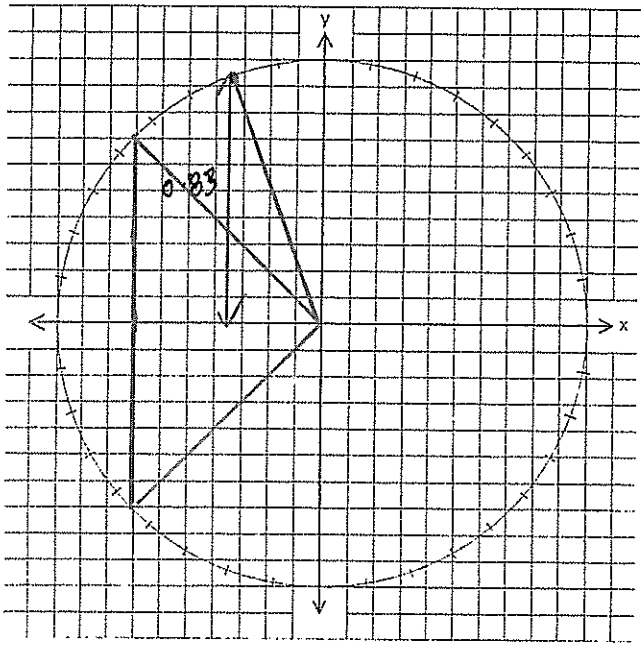
(iii) θ, where $\tan\theta = \frac{1}{\sqrt{3}}$ for $-180° \le \theta \le 180°$

$30°$ and $-150°$

(4 marks)

Question 2 [4 marks]

Use the unit circle below to answer the questions that follow. Give your answers to an appropriate degree of accuracy.



(a) Determine the value of sin 110°

$\sin 110^\circ \approx 0.93$ ✓✓

(2 marks)

(b) Solve for x

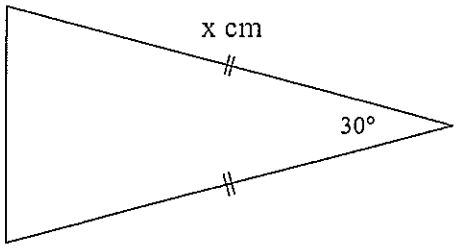
$\cos x^\circ = -0.7$ for $0^\circ \leq x \leq 360^\circ$

135° and 225° ✓ ✓

(2 marks)

Question 3 [4 marks]

The triangle shown below has an area of 36 cm^2, determine the value of x.



$36 = \frac{1}{2} x^2 \sin 30^\circ$ ✓

$36 = \frac{1}{2} x^2 \frac{1}{2}$ ✓

$144 = x^2$ ✓

$x = 12$ ✓

Question 4 **[7 marks]**

Given the functions $f(x) = 2x - 3$ $h(x) = \sqrt{x+4}$

$g(x) = x^2 + 2x - 8$ $j(x) = 4 - \frac{x}{3}$

determine

(a) $h(0) = \sqrt{0+4}$

$= \boxed{2}$ ✓

(1 mark)

(b) $g(-2) = (-2)^2 + 2(-2) - 8$

$= \boxed{-8.}$ ✓

(1 mark)

(c) $f(2t-1) = 2(2t-1) - 3$

$= 4t - 2 - 3$

$= \boxed{4t - 5.}$ ✓

(1 mark)

(c) x such that $f(x) = j(x)$

$2x - 3 = 4 - \frac{x}{3}$ ✓

$\Rightarrow 2x + \frac{x}{3} = 7$

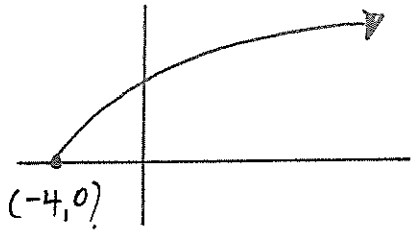
$\Rightarrow \frac{7x}{3} = 7$

$\Rightarrow 7x = 21$

$\boxed{x = 3.}$ ✓

(2 marks)

(d) the domain and range of h(x)



(2 marks)

$\boxed{\begin{array}{ll} dn & x \geq -4 \\ rn & y \geq 0. \end{array}}$ ✓ ✓