

**Eastern Goldfields College**  
**Mathematics Methods 2015**  
**Test 3— Calculator Free Section**

Working Time: 30 minutes

Total Marks: 25 marks

**Question 1 [3 marks]**

Evaluate

$$\begin{aligned} & \left( \sin \frac{\pi}{6} \right) (\cos 10^\circ) + \left( \tan \frac{3\pi}{4} \right) \\ &= \frac{1}{2} \cdot \frac{\sqrt{3}}{2} - 1 \\ &= -\frac{\sqrt{3}}{4} - 1 \end{aligned}$$

**Question 2 [2 marks - 1, 1]**

a) Find the maximum value of the function  $y = 7 - 2 \cos\left(\frac{x}{5}\right)$ .

max 9 ✓

b) Find the period of the function  $y = -4 \tan(2\pi x)$

$P = \frac{1}{2\pi} = \frac{1}{2}$  ✓

**Question 3 [8 marks - 1, 1, 2, 2, 2]**

Given the functions

$f(x) = 17 - 3x$

$h(x) = \sqrt{x+4}$

$j(x) = 4 - \frac{x}{3}$

$g(x) = x^2 - 3x + 11$

determine

(a)  $h(0) = 2$  ✓

(b)  $g(-2) = 21$  ✓

(c)  $f(2t-1) = 17-3(2t-1)$  ✓

$= 17-6t+3 = 20-6t$  ✓

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

$17-3x = x^2-3x+11$  ✓

$6 = x^2$

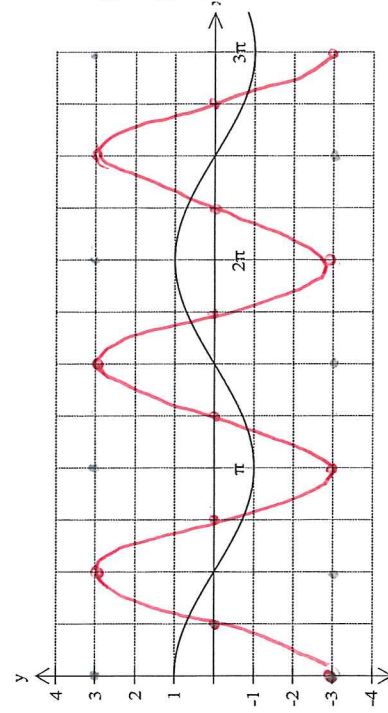
$\pm \sqrt{6} = x$  ✓

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

$D = \{x: x \geq -4, x \in \mathbb{R}\}$  ✓  
 $R = \{y: y \geq 0, y \in \mathbb{R}\}$  ✓

**Question 4 [3 marks - 1, 1]**

The grid below shows a graph of  $y = \cos(x)$  from 0 to  $3\pi$ .



Plot the graph of  $y = -3 \cos(2x)$  on the axes above

Question 5 [9 marks-2, 3, 4]

(a) Solve  $\sin x = -\frac{\sqrt{3}}{2}$ ,  $0 \leq x \leq 2\pi$

$x = \frac{4\pi}{3}, \frac{5\pi}{3}$  ✓ ✓



(b) Solve  $(2\cos x - 1)(\cos x - 1) = 0$ ,  $0 \leq x \leq 2\pi$



$\cos x = \frac{1}{2}$  or  $\cos x = 1$  ✓

$x = \frac{\pi}{3}, \frac{5\pi}{3}$  ✓  $x = 0, 2\pi$  ✓

(c) Solve  $\tan 2x = \frac{1}{\sqrt{3}}$ ,  $-180^\circ \leq x \leq 180^\circ$

$-360^\circ \leq 2x \leq 360^\circ$  ✓  
 $2x = 30^\circ, 210^\circ, -150^\circ, -330^\circ$  ✓  
 $x = 15^\circ, 105^\circ, -75^\circ, -165^\circ$  ✓ ✓



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

Eastern Goldfields College

Mathematics Methods 2015

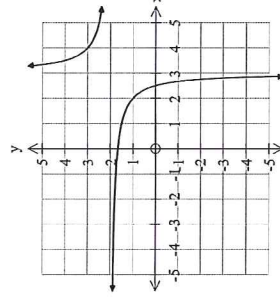
Test 3— Calculator Assumed Section

Working Time: 35 minutes

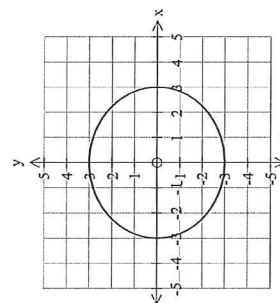
Total Marks: 29 marks

Question 6 [5 marks]

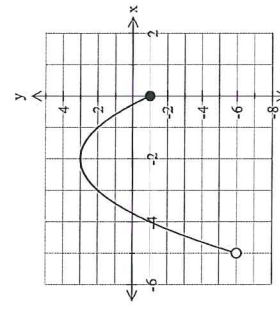
Indicate which of the following represent functions with the letter F. For those that are functions, state the natural domain and corresponding range.



Function F ✓  
 (−1/2 each error)



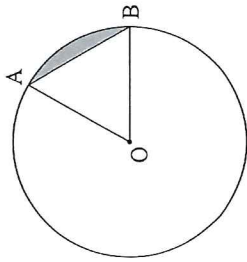
Function F



$D = \{x : x \neq 3, x \in \mathbb{R}\}$  ✓  
 $R = \{y : y \neq 2, y \in \mathbb{R}\}$  ✓  
 $D = \{x : -5 < x \leq 0, x \in \mathbb{R}\}$  ✓  
 $R = \{y : -6 < y \leq 3, y \in \mathbb{R}\}$  ✓

### Question 7 [8 marks - 2, 2, 2, 2]

The circle shown with centre O has a radius of  $3\pi$  cm.



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

- (a) area of triangle AOB as an exact value in terms of  $\pi$ .

$$A = \frac{1}{2} 3\pi \cdot 3\pi \sin 60^\circ \checkmark$$

$$= \frac{9\sqrt{3}\pi^2}{4} \text{ cm}^2 \checkmark$$

(38.46)

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

$$l = \frac{300}{360} \times 2\pi \times 3\pi \checkmark$$

$$= 49.35 \text{ cm} \checkmark$$

- (c) area of the *minor* sector AOB to the nearest  $\text{cm}^2$ .

$$A = \frac{1}{2} (3\pi)^2 \frac{\pi}{3} \checkmark$$

$$= 47 \text{ cm}^2 \checkmark$$

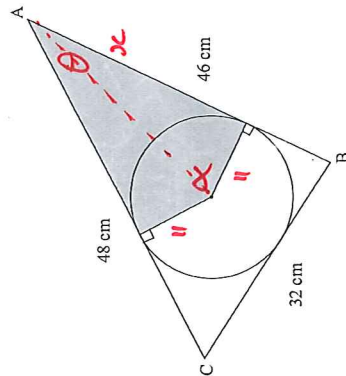
- (d) area of the *minor* segment (shaded) formed by the chord AB accurate to 3 significant figures.

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

$$= 8.05 \text{ cm}^2 \text{ (3 sig figs)} \checkmark$$

### 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  $\angle BAC$ ).

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

$$\theta = 39.7^\circ \checkmark \quad (0.69)$$

$$\alpha = 180 - \theta = 140.3^\circ \checkmark \quad (2.45)$$

$$\tan \frac{1}{2} \alpha = \frac{x}{11}$$

$$(30.44) \quad 11 \cdot \tan \frac{1}{2} \alpha = x \checkmark$$

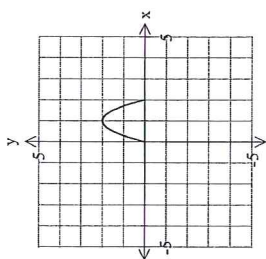
$$\text{Area } \Delta = 2 \times \left( \frac{1}{2} 11 \cdot 11 \cdot \tan \frac{1}{2} \alpha \right) \checkmark$$

$$= 334.9 \text{ cm}^2 \checkmark$$

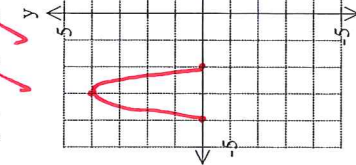
Question 9 [4 marks - 2, 2]

Shown to the right is a graph of the function  $f(x)$

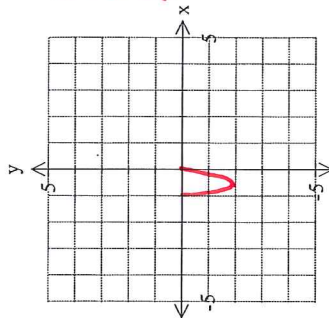
Using your knowledge of transformations sketch the following.



a)  $y = 2f(x+4)$



b)  $y = -f(-2x)$



✓ t m d t h  
✓ 1/2 reflect about x-axis  
✓ 1/2 reflect about y-axis

Question 10 [7 marks - 2, 3, 2]

- a) State the rule for a circle with a radius of  $\sqrt{11}$  with a centre of  $(-2, 1)$ .

$$(x+2)^2 + (y-1)^2 = 11$$

- b) Write the rule in the form  $x^2 + y^2 + dx + ey = f$

$$x^2 + 4x + 4 + y^2 - 2y + 1 = 11$$

$$x^2 + y^2 + 4x - 2y = 6$$

Determine the distance from the closest point on the circle to the origin at  $(0, 0)$

