Manjimup SHS 2015

Year 11 Mathematics Methods Test 3

Quadratics, Functions, Transformations, Trigonometry

Name: ANSWERS.

Score: _____ out of 30

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

Time: 30 minutes **Marks: 30 marks**

/56

1. [2,2,2 = 6 marks]

Use algebra to solve the following equations.

a) $(4x-5)(x+3)=0$

$4x=5$ or $x=-3$

$x=\frac{5}{4}$ or -3.

b) $x^2=2x+15$

$x^2-2x-15=0$

$(x-5)(x+3)=0$

$x=5$ or -3

c) $x^3-4x^2=0$

$x^2(x-4)=0$

$x=0$ or 4

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2. [2 marks]

Find the exact values of

a) $\cos 210^\circ$

$=-\cos 30^\circ$

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

b) $\tan\left(\frac{2\pi}{3}\right)$

$=-\tan\frac{\pi}{3}=-\sqrt{3}$.

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3. [3 marks]

Consider the quadratic function $f(x)=x^2-8x-9$

Find the turning point of f(x), by using the completing the square method.

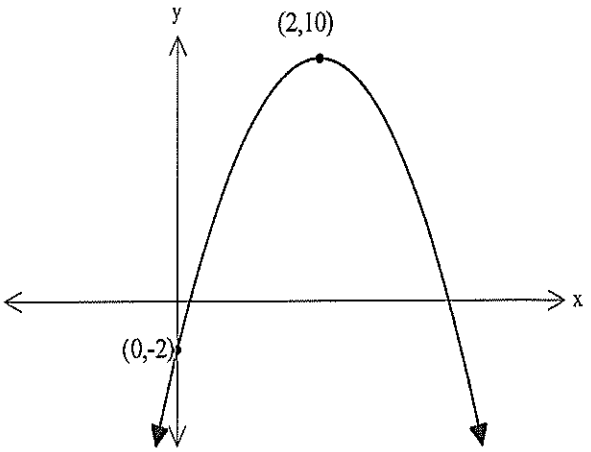
$f(x)=x^2-8x+16-9-16$

$=(x-4)^2-25$

TP $(4,-25)$

4. [3,2 = 5 marks]

The rule for the graph shown is $y = a(x-h)^2 + k$



a) Determine the values of a, h and k and write the full rule below.

$h = 2$, $k = 10$ | $y = a(x-2)^2 + 10$

$(0,-2) \Rightarrow -2 = a(-2)^2 + 10$

$-2 = 4a + 10$

$4a = -12 \Rightarrow a = -3$

$y = -3(x-2)^2 + 10$

b) Use algebra to change your rule into standard form; $y = ax^2 + bx + c$

$-3(x-2)^2 + 10 = -3(x^2 - 4x + 4) + 10$

$= -3x^2 + 12x - 12 + 10$

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

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5. [2 marks]

Consider the rule: $y = 7 - 2\cos\left(\frac{x}{5}\right)$.

a) Find the maximum value of the function $y = 7 - 2\cos\left(\frac{x}{5}\right)$. $7 + 2 = 9$ (max value)

b) Find the period of the function $y = -4\tan(2\pi x)$ $T = \frac{\pi}{2\pi} = \frac{1}{2}$

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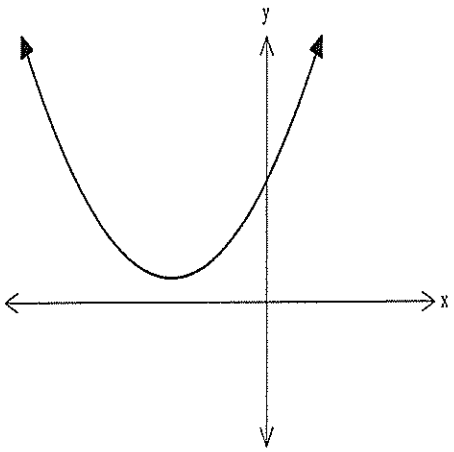
6. [2 marks]

This following graph has no roots.



Select the correct rule from the list below.
Justify your answer using mathematics.

$y = x^2 + 4x + 3$ $y = x^2 + 4x + 4$ $y = x^2 + 4x + 5$

$b^2 - 4ac$

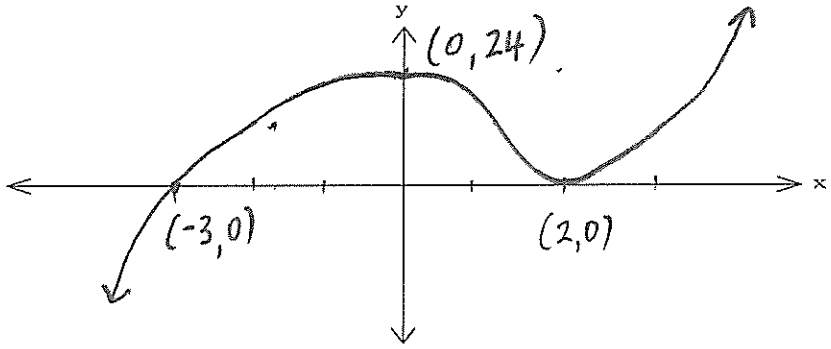
$4^2 - 4(3)(1)$ $4^2 - 4(4)(1)$ $4^2 - 4(5)(1)$

$= +4$ $= 0$ $= -4$

(2 roots) (1 root) (no roots)

7. [3 marks]

Sketch the cubic $y = 2(x + 3)(x - 2)^2$ indicating all roots and y-intercepts.



$x = 0$

$\Rightarrow y = 2(3)(-2)^2$

$= 24.$

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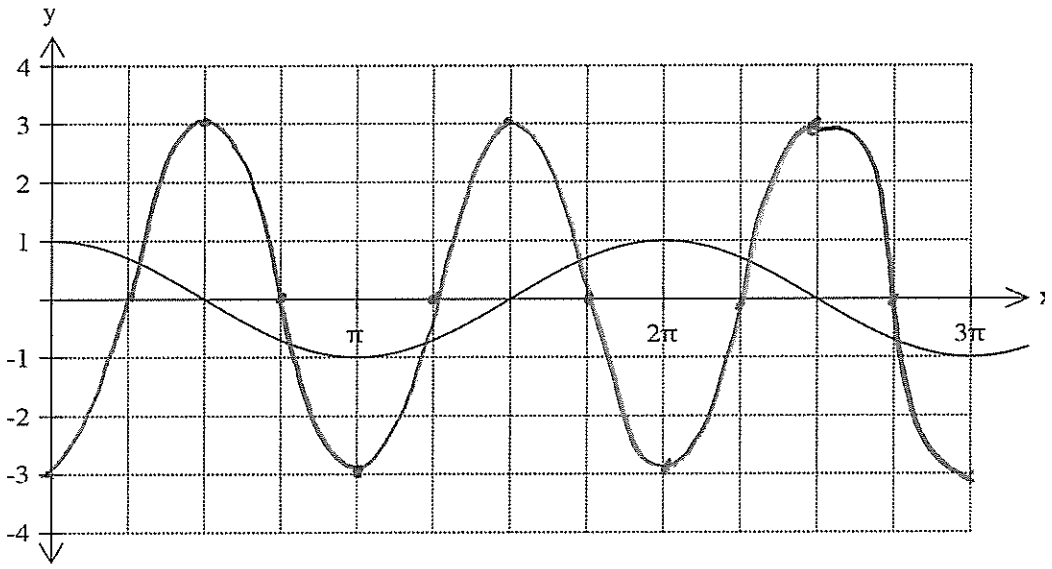
8. [3 marks]

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



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

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9. [4 marks]

Find all solutions to the equation $\cos(2x) = 0.5$ for the domain $0 \leq x \leq 360^\circ$

Q1+4.

Ref angle 60°.

$2x = 60^\circ, 300^\circ, 420^\circ, 660^\circ$

$x = \{30^\circ, 150^\circ, 210^\circ, 330^\circ\}$.

Manjimup SHS 2015

Year 11 Mathematics Methods
Test 3

Quadratics, Functions, Transformations, Trigonometry

Name:

Score: ____ out of **26**

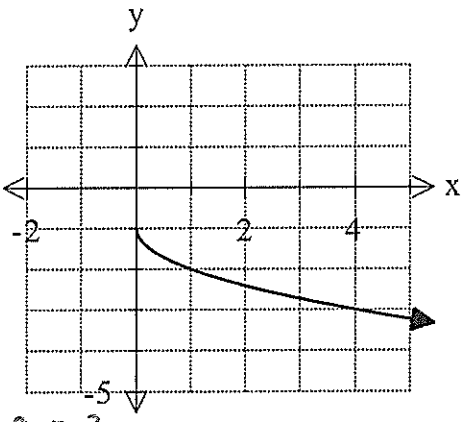
Calculator Section (Calculators and 1 page (A4) of notes permitted, formula sheet provided)

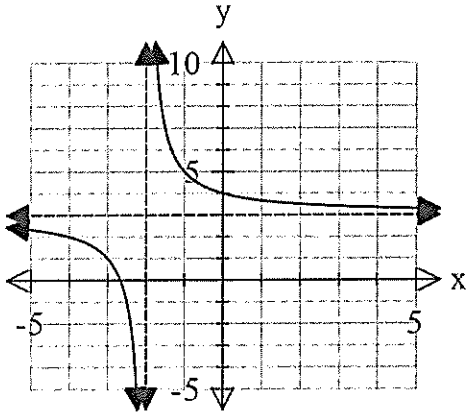
Time: 40 minutes **Marks: 33 marks**

10. [4 marks]

Determine the rules for these functions.

$y = -\sqrt{x} - 1$





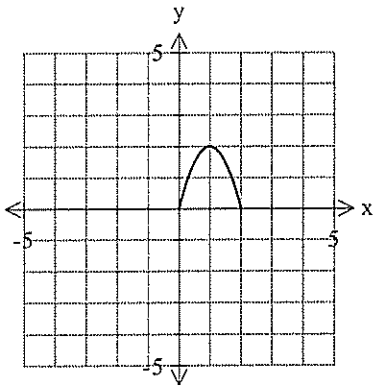
$y = \frac{2}{x+1} + 3$

$(0,4) \Rightarrow 4 = \frac{a}{2} + 3$

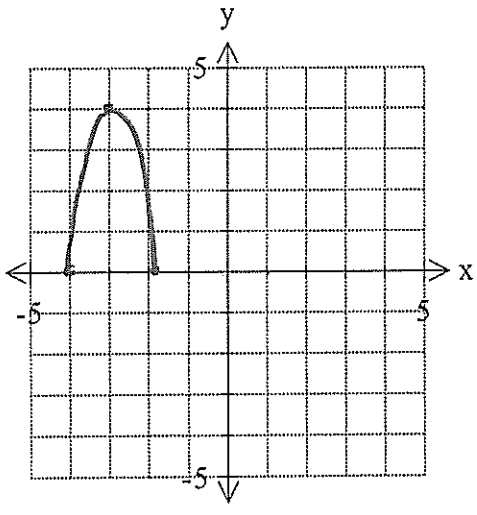
$a = 2$

11. [2,3 = 4 marks]

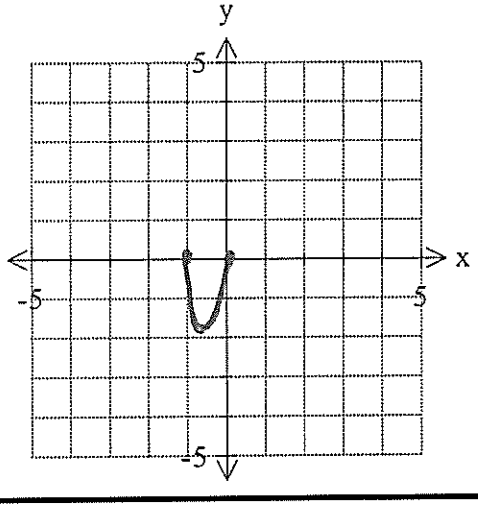
Shown to the right is a graph of the function f(x). Using your knowledge of transformations sketch the following



a) $y = 2f(x + 4)$ ✓



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



12. [2,3,2 = 7 marks]

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 $x^2 + y^2 + dx + ey = f$

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

$$x^2 + 4x + y^2 - 2y = 11 - 5$$

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

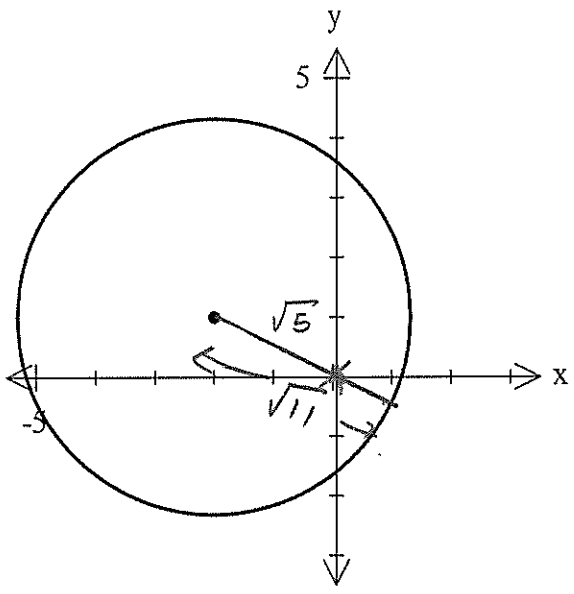
c) Determine the distance from the closest point on the circle to the origin at (0,0)

Distance centre - origin

$(-2,1) - (0,0)$

$d = \sqrt{2^2 + 1^2}$

$= \sqrt{5}$.



$\Rightarrow$ Closest distance $= \sqrt{11} - \sqrt{5}$.

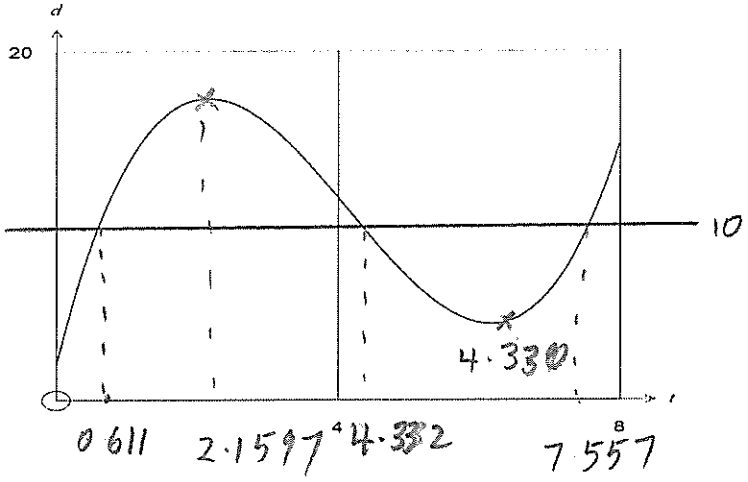
13. [1,4,1,2 = 8 marks]

The depth of water in a flask in a science experiment was measured for an eight hour period and followed the rule $d = 0.4t^3 - 5t^2 + 16t + 2$, where t was the number of hours since the experiment began and d the depth of water in centimetres.

a) What was the depth of water when the experiment began?

$d(0) =$ 2cm.

Graph $d = 0.4t^3 - 5t^2 + 16t + 2$ on your calculator. Use it to answer the following questions



b) In total for how many hours and minutes was the depth 10cm or more during the eight hour period?

Time above 10cm $= (4.332 - 0.611) + (8 - 7.557)$

$= 4.164$ hours

$=$ 4h 10 mins.

c) What was the minimum depth of water during the first eight hours?

min 4·33cm

nearest minute.

d) At what time, correct to ~~2 decimal places~~, was the depth a maximum during the first eight hours?

2·1597 hours.

$=$ 2 hours 9.58 min

14. [3 marks]

Use the *quadratic formula* to solve $0 = 10x^2 - x - 2$. Show all steps clearly.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{1 \pm \sqrt{(-1)^2 - 4(10)(-2)}}{20}$$

$$= \frac{1 \pm \sqrt{81}}{20}$$

$$= \frac{1 \pm 9}{20}$$

$$= \frac{1+9}{20} \text{ and } \frac{1-9}{20}$$

$$= \frac{10}{20} \text{ and } \frac{-8}{20}$$

$$= \frac{1}{2} \text{ and } -\frac{2}{5}.$$