Penrith Selective High School

2018

Year 10
Assessment Task 2

Mathematics

Time Allowed: 60 minutes

General Instructions

- Write using black or blue pen.
- Calculators may be used in this test.
- All necessary working should be shown in every question.
- Attempt all questions.
- Diagrams are not to scale.
- No correction tape or liquid paper allowed.

Marks

Non-linear Relationships	/ 41
Circle Geometry	/ 17
Total	**/ 58**
	%

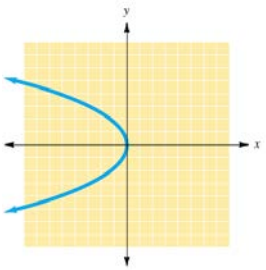
Student's Name: _____

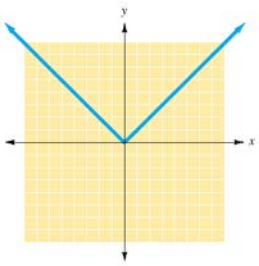
Teacher: _____

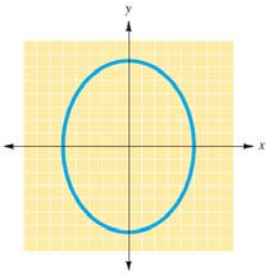
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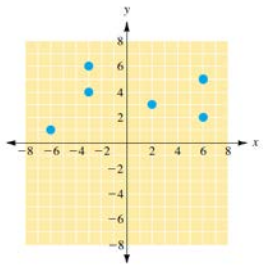
Section I – Non-linear relationships (41 Marks)

1. State 'function (F)' or 'not a function (N)' for each of the following graphs. **4**

a) 

b) 

c) 

d) 

2. What is the equation of a circle with centre at the origin and radius of 3? **1**

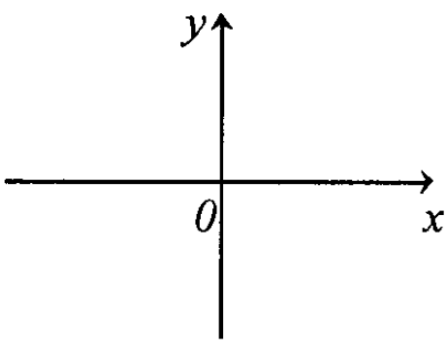
3. Multiple Choice Question. The centre and radius of the circle $(x + 1)^2 + (y - 3)^2 = 4$ is: **1**

(A) (1, −3), 4 (B) (−1, 3), 2

(C) (3, −1), 4 (D) (1, −3), 2

4. Sketch the following functions and state the domain and range for each. **9**

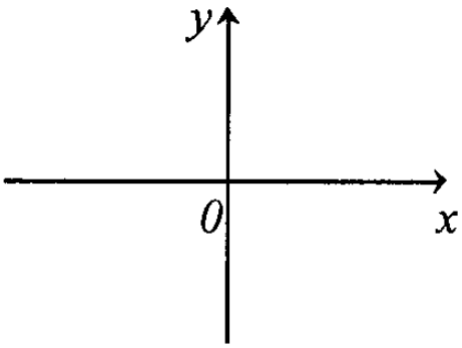
i) $x^2 + y^2 = 9$



D:

R:

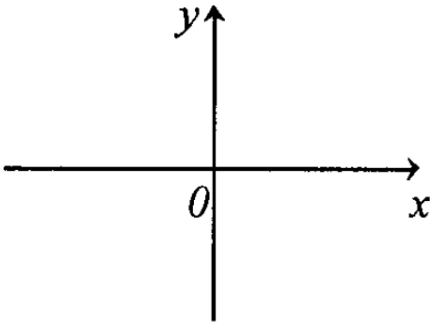
ii) $y = x^3 + 5$



D:

R:

iii) $y = 2^x$



D: _____

R: _____

5. Given $y = 2^x$, write the new equation if it is translated down 3 units, and then reflected in the y-axis. **2**

6. (a) If $g(x) = \frac{1}{x}$, find $g(1)$ **1**

(b) show that $\frac{g(x)-g(1)}{x-1} = -\frac{1}{x}$ **2**

7. Given $f(x) = \begin{cases} x, & x < -4 \\ 2x - 5, & -4 \leq x \leq 6 \\ x^2, & x > 6 \end{cases}$ **2**

Evaluate $f(2) + f(-3) + f(7)$

8. The function f is such that $f(x) = 4x - 1$. The function g is such that $g(x) = kx^2$

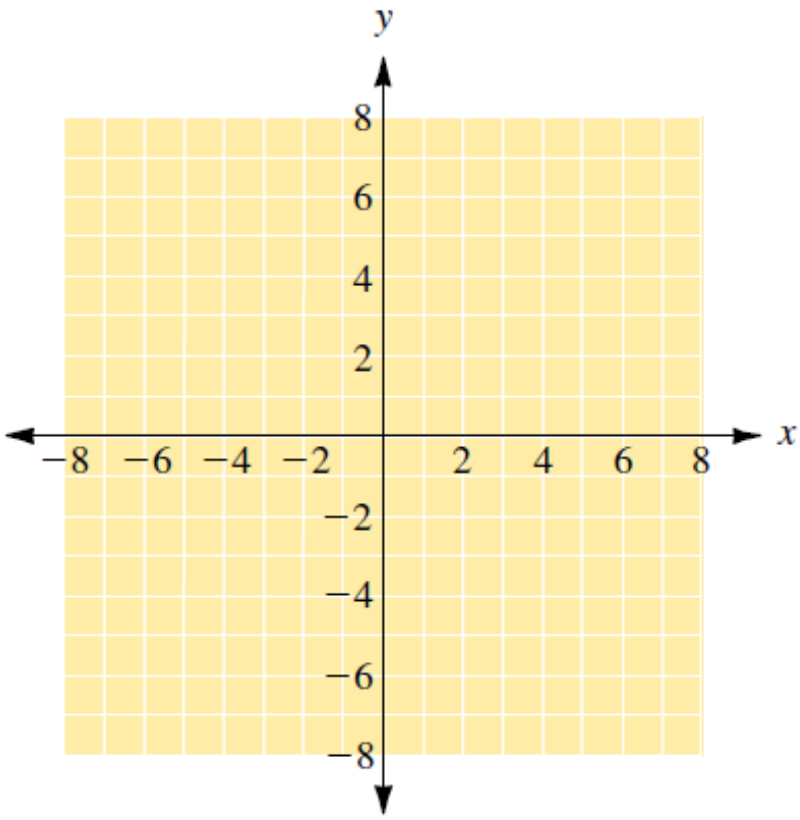
Given that $f(g(x)) = 12$. Find the value of ***k***. **2**

9. For $y = \frac{1}{x-1} + 2$

(a) Find any x and y intercepts. **2**

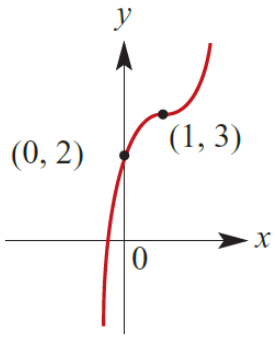
(b) Write down the equation(s) of any asymptote (s). **2**

(c) Hence, sketch the graph of $y = \frac{1}{x-1} + 2$. Showing the above features. **2**

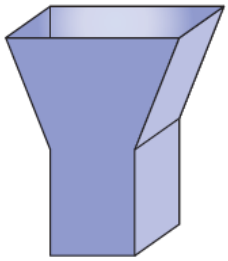


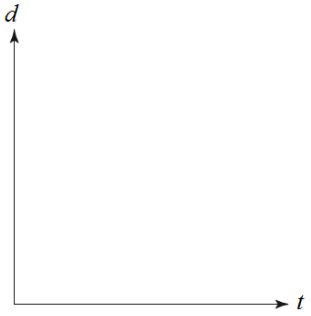
10. Solve $-2(x-5)^3 = 152$ **2**

11. What is the equation of the graph shown below. **1**



12. Water is poured at a constant rate into the container shown below. Draw a sketch of water depth against time. (Numbers are not required). **1**



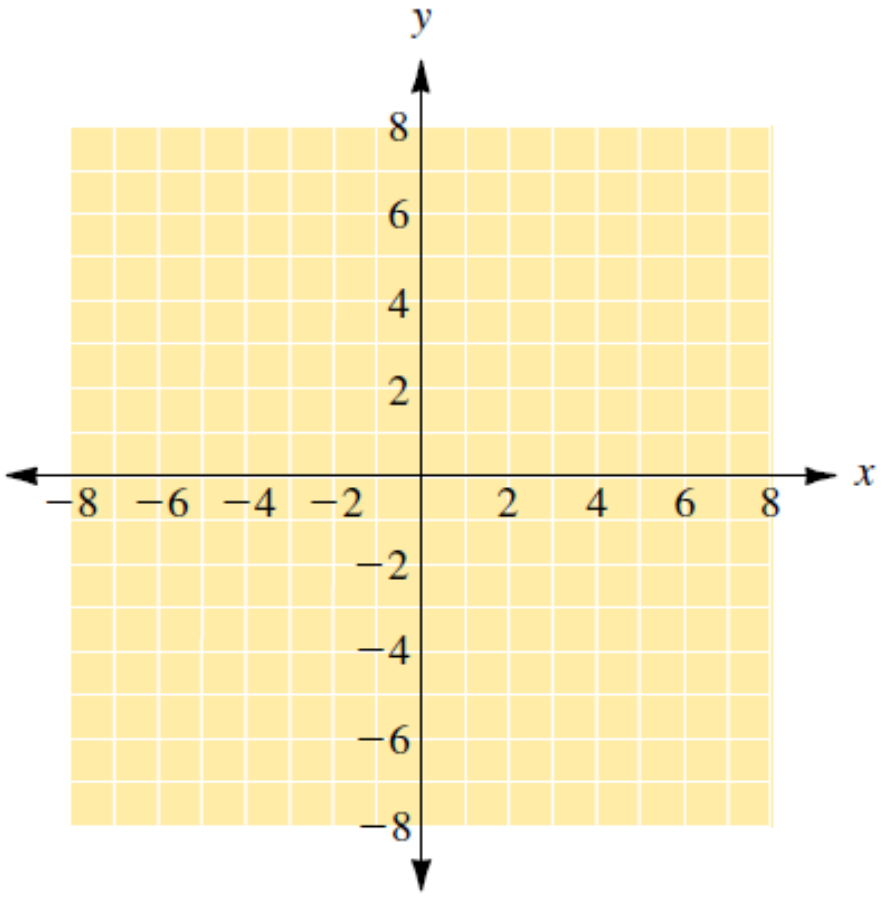


13. Write the inverse function of $y = 2x - 3$. **2**

14. Show that the inverse of function of $y = \frac{ax+b}{x+c}$ is $y = \frac{b-cx}{x-a}$. **2**

15. a) Suggest a restriction on the domain of $y = -\sqrt{4 - x^2}$ so that its inverse is a function. **1**

b) Sketch and clearly label the modified function and its inverse. **2**

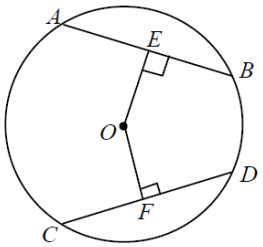


END OF SECTION I

Section II – Circle Geometry (17 marks)

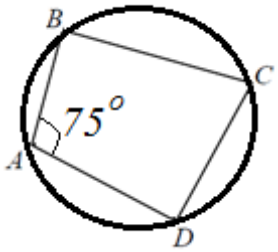
1. Given the following data in the figures below, fill in the spaces. **2**

a)



$OE = OF$ then $AB =$……

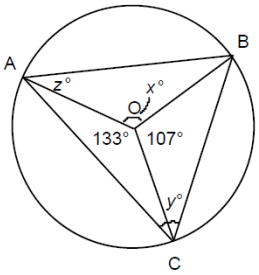
b)



$ABCD$ is a cyclic quadrilateral.

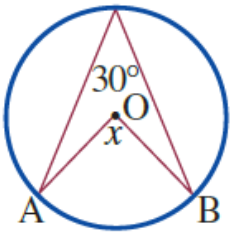
$\angle DCB =$ ……

2. Point O is the centre of the circle. **3**
Determine the values of $x°$, $y°$, and $z°$. No reasoning required.

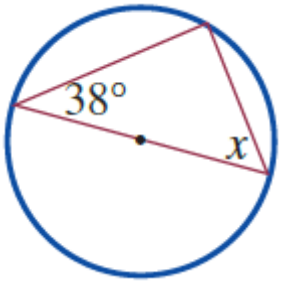


3. Find the value of the pronumerals. No reasoning required. **4**

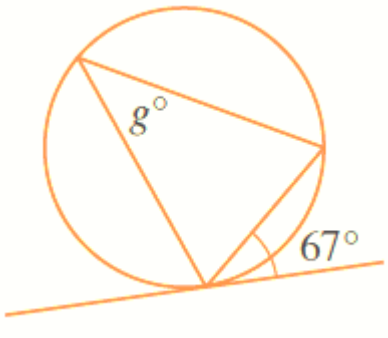
a)



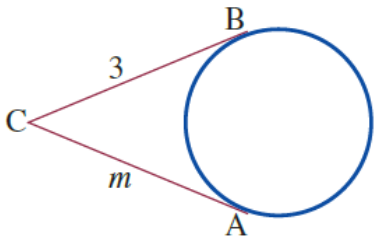
b)



c)



d)



4. *A*, *B*, *C* and *D* are four points on the circumference of a circle. *ABE* and *DCE* are straight lines.

Angle *BAC* = 25°.

Angle *EBC* = 60°.

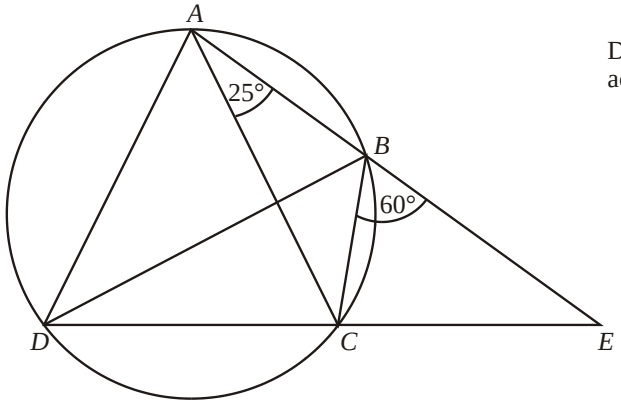


Diagram **NOT** accurately drawn

a) Find the size of angle BDC. Give a reason for your answer. **2**

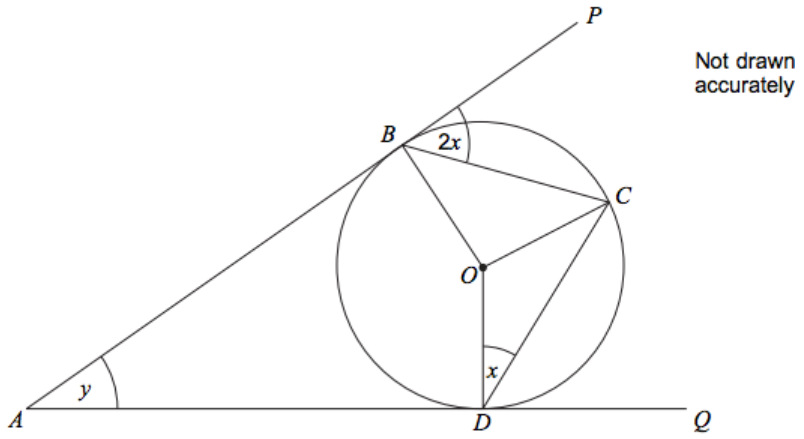
b) Find the size of angle ADC. **1**

c) Find the size of angle ADB. **1**

Section II continues on page 10

5. ABP and ADQ are tangents to the circle, centre O.

C lies on the circumference of the circle.



i) Find the size of angle OBP **1**

ii) Prove that $y = 2x$. Give reasons for any statements you make. **3**

END OF EXAMINATION

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2018

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Assessment Task 2

SOLUTIONS

Mathematics

Time Allowed: 60 minutes

General Instructions

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Non-linear Relationships	/ 41
Circle Geometry	/ 17
Total	**/ 58**
	%

Student's Name: _____

Teacher: _____

8. The function f is such that $f(x) = 4x - 1$. The function g is such that $g(x) = kx^2$

Given that $f(g(2)) = 12$. Find the value of k. **2**

$f(g(2)) = 12$ ✓ since $g(2) = 4k$

$4(4k) - 1 = 12$

$16k = 13$

$k = \frac{13}{16}$ ✓

9. For $y = \frac{1}{x-1} + 2$

(a) Find any x and y intercepts. **2**

x-intercept: let $y = 0$, $\frac{1}{x-1} + 2 = 0$

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

$-2x + 2 = 1$

$x = \frac{1}{2}$ ✓

y-intercept: let $x = 0$

$\frac{1}{0-1} + 2 = y$

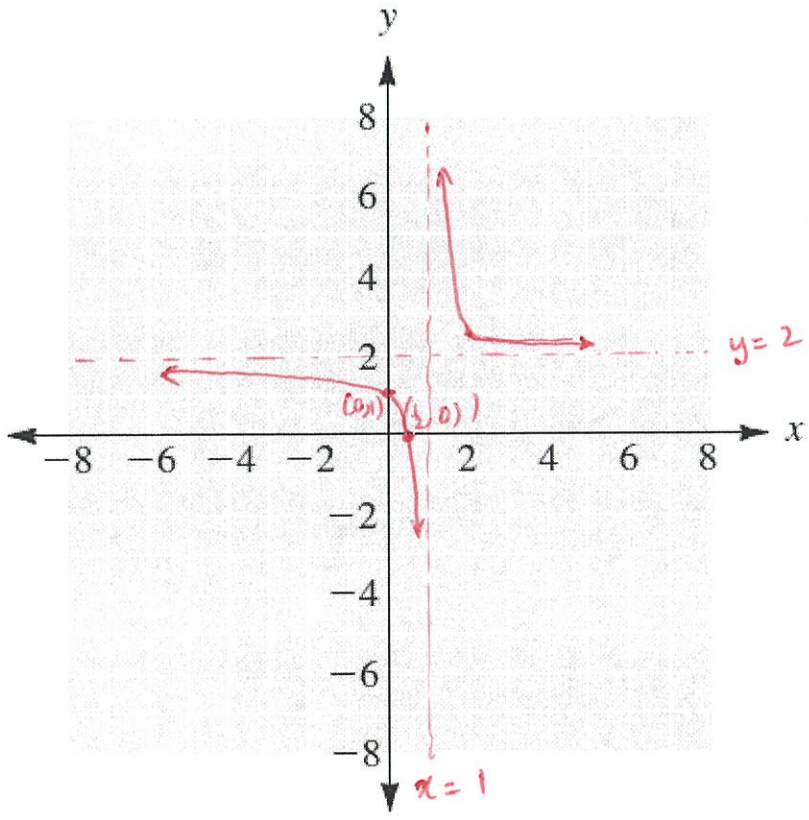
$-1 + 2 = y$

$y = 1$ ✓

(b) Write down the equation(s) of any asymptote (s). **2**

asymptotes: $x = 1$ ✓ $y = 2$ ✓

(c) Hence, sketch the graph of $y = \frac{1}{x-1} + 2$. Showing the above features. **2**



(1) asymptotes

(1) shape.

(½) intercepts

10. Solve $-2(x-5)^3 = 152$ **2**

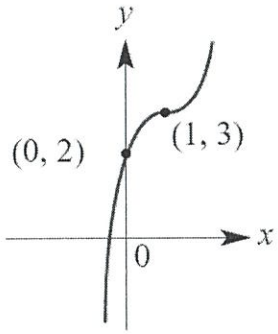
$(x-5)^3 = -76$

$x-5 = \sqrt[3]{-76}$ ✓

$x = -4.2358 + 5$

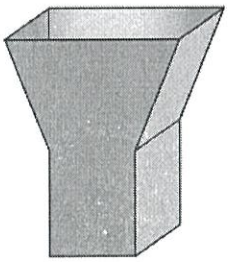
$x = 0.76$ (to 2 dp) ✓

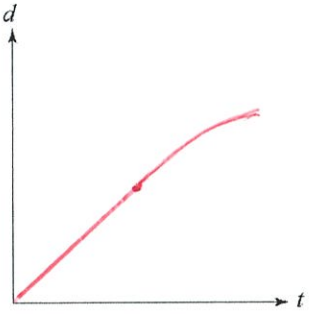
11. What is the equation of the graph shown below. **1**



$y = (x-1)^3 + 3$ ✓

12. Water is poured at a constant rate into the container shown below. Draw a sketch of water depth against time. (Numbers are not required). **1**





✓

13. Write the inverse function of $y = 2x - 3$. **2**

$x = 2y - 3$

$2y = x + 3$ ✓

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

$\therefore f^{-1}(x) = \frac{x+3}{2}$ ✓

14. Show that the inverse of function of $y = \frac{ax+b}{x+c}$ is $y = \frac{b-cx}{x-a}$. **2**

$x = \frac{ay+b}{y+c}$

$x(y+c) = ay+b$ ✓

$xy + xc = ay + b$

$xy - ay = b - xc$

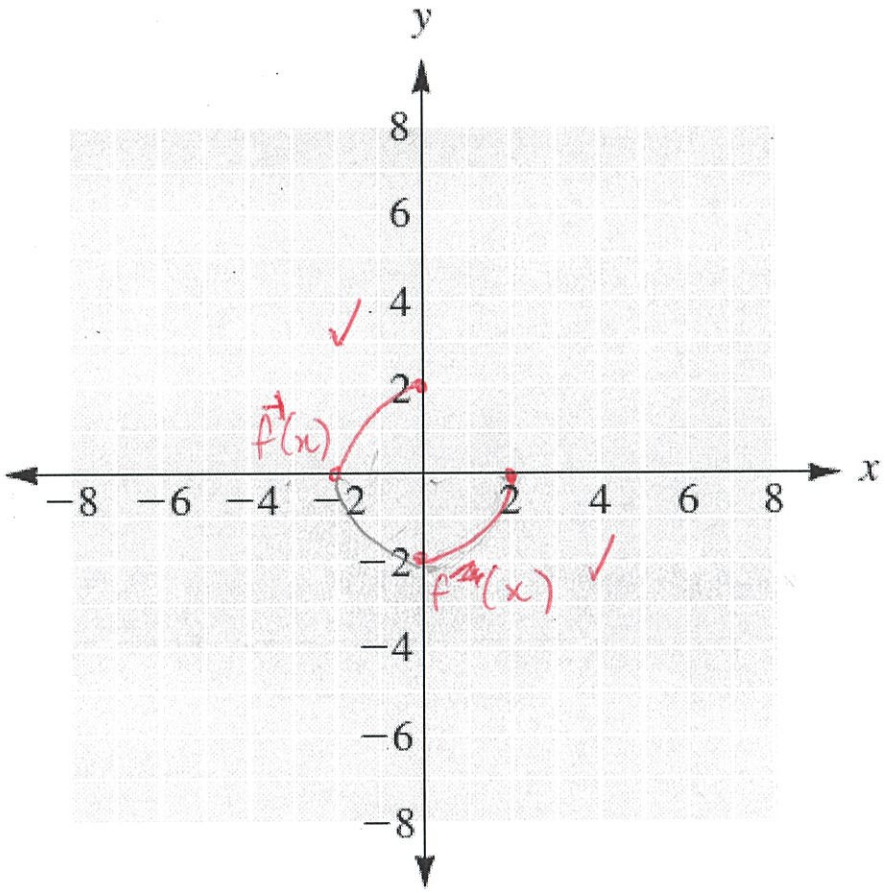
$(x-a)y = \frac{b-xc}{x-a}$ ✓

$y = \frac{b-cx}{x-a}$

15. a) Suggest a restriction on the domain of $y = -\sqrt{4 - x^2}$ so that its inverse is a function. **1**

suggested $0 \leq x \leq 2$

b) Sketch and clearly label the modified function and its inverse. **2**

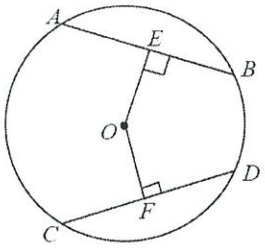


END OF SECTION I

Section II – Circle Geometry (17 marks)

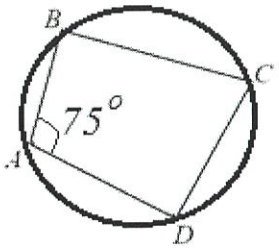
1. Given the following data in the figures below, fill in the spaces. **2**

a)



$OE = OF$ then $AB =$ ..... CD ✓

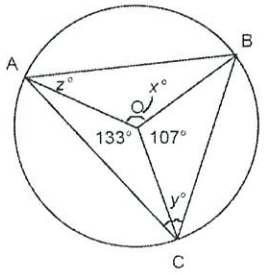
b)



$ABCD$ is a cyclic quadrilateral. ✓

$\angle DCB =$ ..... 105° ✓

2. Point O is the centre of the circle. **3**
Determine the values of $x°$, $y°$, and $z°$. No reasoning required.



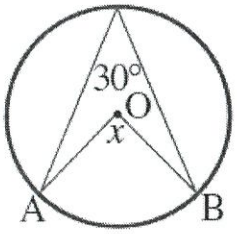
$x = 120°$ ✓

$y = 23.5° + 36.5° = 60°$ ✓

$z = 30°$ ✓

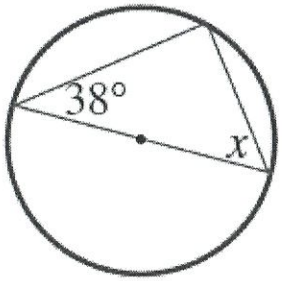
3. Find the value of the pronumerals. No reasoning required. **4**

a)



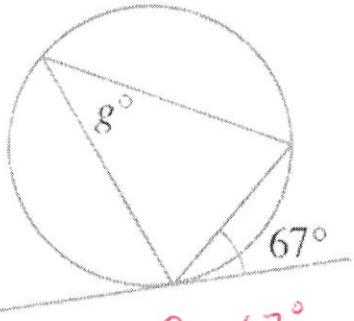
$x = 60°$ ✓

b)



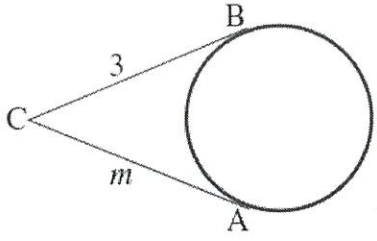
$x = 52°$ ✓

c)



$g = 67°$ ✓

d)



$m = 3°$ ✓

4. A, B, C and D are four points on the circumference of a circle. ABE and DCE are straight lines.

Angle $BAC = 25°$.

Angle $EBC = 60°$.

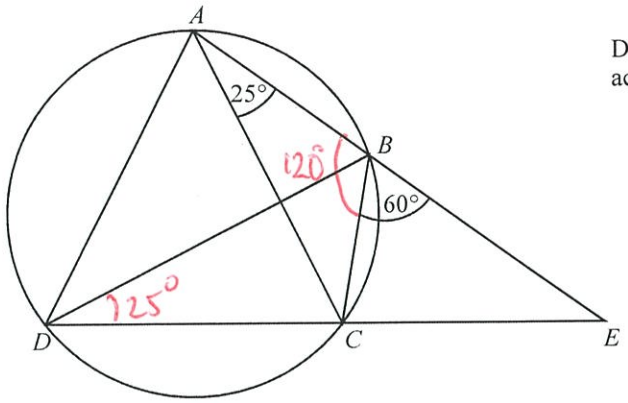


Diagram **NOT** accurately drawn

a) Find the size of angle BDC. Give a reason for your answer. **2**

$\angle BDC = 25°$ (angles at the circumference subtended by the same arc are equal)

b) Find the size of angle ADC. **1**

$\angle ADC = 60°$ ✓

c) Find the size of angle ADB. **1**

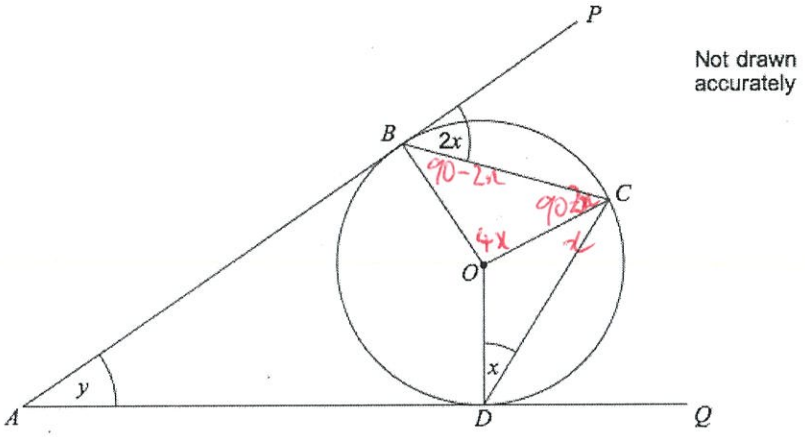
$\angle ADB = 60° - 25°$ ✓

$= 35°$

Section II continues on page 10

5. ABP and ADQ are tangents to the circle, centre O.

C lies on the circumference of the circle.



i) Find the size of angle OBP. **1**

$\angle OBP = 90°$ ✓ (radius ⊥ tangent).

reasoning not required

ii) Prove that $y = 2x$. Give reasons for any statements you make. **3**

In $\triangle OBC$: $OB = OC$ (equal radii)

$\angle OBC = OCB$ (angles opposite equal sides are equal)

$= 90 - 2x$

$2(90-2x) + \angle BOC = 180°$ (angle sum of triangle)

$\angle BOC = 180 - 180 + 4x$

$= 4x$ ✓

In $\triangle OCD$: $OC = OD$

$\angle ODC = \angle OCD$ (angles opposite equal sides are equal)

$= x$

$\therefore \angle BCD = 90 - 2x + x$

$= 90 - x$

$\angle BOD = 2(90 - x)$ (angle at centre is double angle at the circumference subtended by same arc) ✓

$= 180 - 2x$

$\angle OBA = \angle ODA$ (radius ⊥ tangent)

$= 90°$

END OF EXAMINATION

$\angle BAD + 90° + 90° + 180 - 2x = 360°$ (angle sum of quadrilateral) ✓

$y + 180 + 180 - 2x = 360$

$y - 2x = 0$

$y = 2x$