

NAME: _____

TEACHER: _____

BAULKHAM HILLS HIGH SCHOOL

YEAR 9 YEARLY EXAMINATION

2010

MATHEMATICS

Time allowed – Seventy minutes (70) minutes + 5minutes reading time

DIRECTIONS TO CANDIDATES:

PART A:

- 18 short answer questions. Answer, with working, in the space provided.

PART B:

- 6 longer answer questions. Show ALL necessary working in the space provided.

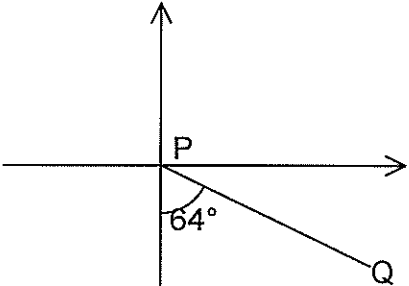
PART C:

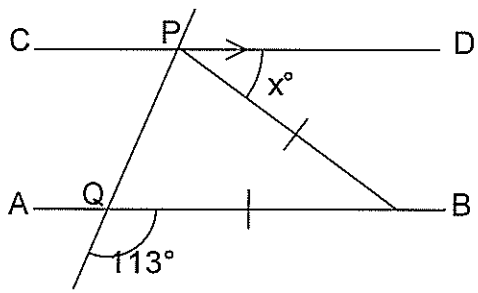
- 10 multiple choice questions. CIRCLE the letter for the correct answer.

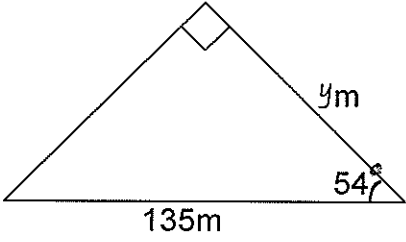
Section A: Short Answer Questions.

Question

Answer

<p>Q1 Evaluate $\frac{23 \times \sqrt{27.2}}{56 - 1.7^2}$ correct to 3 significant figures.</p>	
<p>Q2 What is the true bearing of P from Q.</p> 	
<p>Q3 A clothing company offers a discount of 12% off the regular price to its employees. If an employee pays \$110 for a suit, what is the regular price for the suit?</p>	
<p>Q4 Factorise $x^2 + 4x - 21$</p>	
<p>Q5 Write the equation of a line through (2, 3) parallel to the $x -$ axis.</p>	
<p>Q6 Simplify $2p^2 \times 3p^3q^2$</p>	
<p>Q7 Find the size of each interior angle of a regular 12 sided polygon.</p>	

<p>Q8 Write the exact value of $\tan 45^\circ \times \cos 45^\circ$</p>	
<p>Q9 If $x^2 - y^2 = 64$ and $x + y = 16$, then find the value of $x - y$.</p>	
<p>Q10 Solve for x $\cos x^\circ = \sin 35^\circ$</p>	
<p>Q11 Solve the following inequality $3x - 29 \leq 4x + 12$</p>	
<p>Q12 Simplify $\sqrt{63} - \sqrt{28}$</p>	
<p>Q13 Simplify $(2 - 3x) - (5 - 4x)$</p>	
<p>Q14 Find the value of x, no reason required</p> 	
<p>Q15 If $\sin \theta = \frac{3}{7}$, find the exact value of $\tan \theta$.</p>	

<p>Q16 Find the value of y, to two decimal places</p> 	
<p>Q17 A cube has the surface area of 150 cm^2. What is the side length of the cube?</p>	
<p>Q18 If $5^k(5^2)^3 = 1$, find k.</p>	

Section B: Show all necessary working in the space provided.

Question 1:

- (a) Solve the following equation $3x^2 = 2x + 2$ and write the answer as simplest surd form.
- (b) Tickets for a river cruise cost \$15 for an adult and \$8 for a child. For one cruise, 46 tickets were sold and the money received for these was \$438. Form two equations and use them to find the number of adult tickets sold for the cruise.

(c) Solve the following equation $\frac{2x-5}{3} - \frac{x+7}{5} = 2$

Question 2:

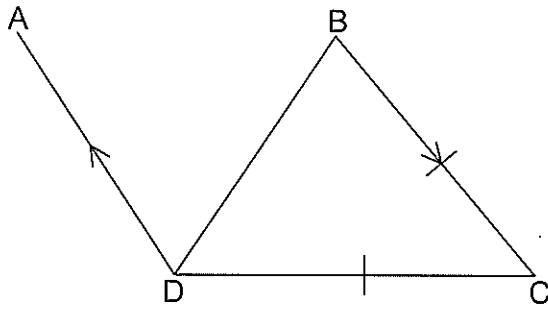
(a) Tina works in a restaurant and earns \$7.20 per hour at the normal rate. At present, each week, Tina works for 11 hours at the normal rate and 4 hours at time and a half.

(i) Find Tina's weekly wage.

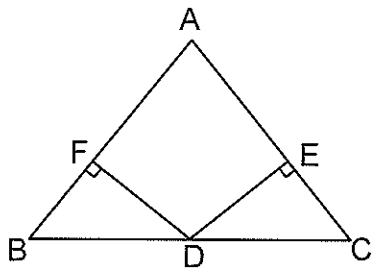
(ii) Tina wants to increase her weekly wage in part (i) to \$180 by working extra hours at normal rate. How many extra hours must Tina work?

(iii) Tina's hourly rate is increased by 6%. Find the new hourly rate for normal hours, to the nearest cent.

(b) $AD \parallel BC$ and $BC = DC$. Prove that BD bisects $\angle ADC$, giving reasons.

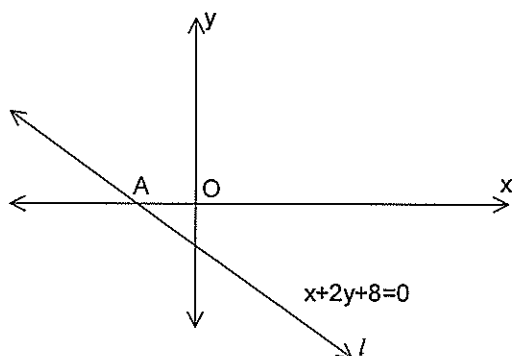


(c) If the mid-point D of the base BC of a triangle ABC is equidistant from its other sides. Prove that the triangle ABC is isosceles.



Question 3 :

The line l is shown in the diagram. It has equation $x + 2y + 8 = 0$ and cut the



x-axis at A. The line k has the equation $y = -\frac{1}{2}x + 6$, and is not shown on the diagram.

- (i) Find the coordinates of A

- (ii) Explain why k is parallel to l .

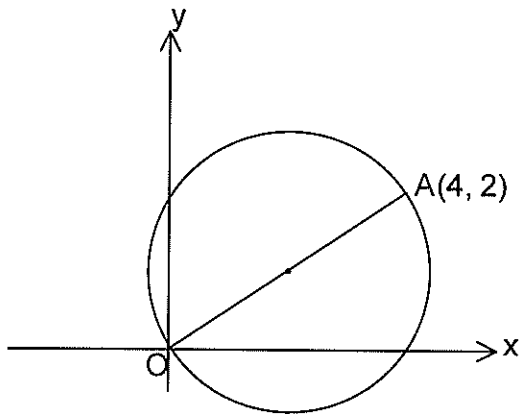
- (iii) Draw the graph of k on your diagram, indicating where it cuts the axes.
- (iv) Shade the region $x + 2y + 8 \leq 0$ on your diagram

- (v) Show that $P(8, 2)$ lies on k .

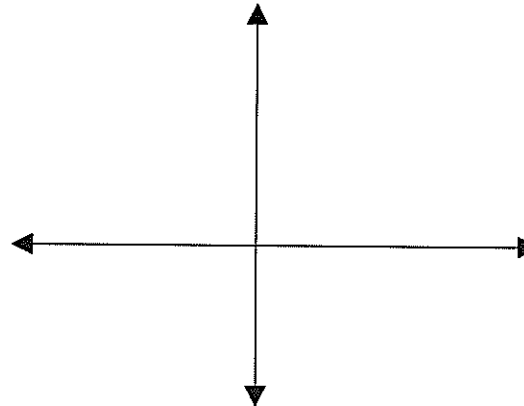
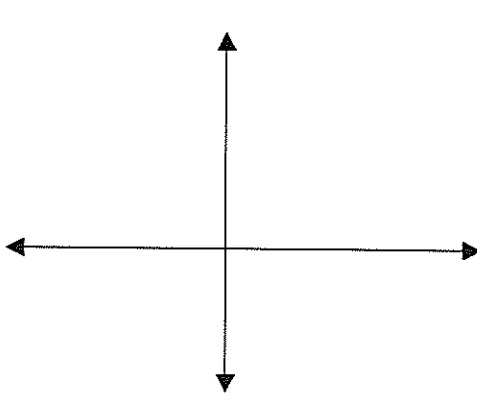
Question 4 :

- (a) Given that x varies directly as y and inversely as z ; and that $x = 8$ when $y = 10$ and $z = 15$. Find x if $y = 4$ and $z = 3$.

- (b) Find the equation of this circle with the diameter OA



- (c) Sketch the graph of the following showing all the important features.

<p>(i) $y = -\frac{1}{x^3} - 1$</p> 	<p>(ii) $y = x + 2 + 1$</p> 
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Question 5 :

(a) Simplify, leaving your answer without negative indices

$$\frac{x^{-2} - y^{-2}}{x^{-1} + y^{-1}}$$

(b) Find a and b if $\frac{2\sqrt{5}}{3\sqrt{5} + 4} = a + b\sqrt{5}$

(c) The circumference of a circle increases from π units to 2π units. What increase occurs in its area?

(d) If $\frac{3a+4b}{2a-2b} = 5$, then find value of $\frac{a^2+2b^2}{ab}$

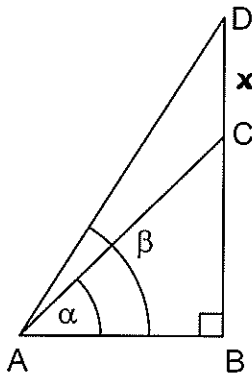
Question 6:

(a) A solid cone has a diameter of 3.4 cm and perpendicular height of 1.5cm. Calculate to 2 decimal place

(i) the slant height.

(ii) the surface area of the cone.

(b) A vertical tower BC stands on horizontal plane and is surmounted by a vertical flagstaff DC of height x . At a point on the plane, the angle of elevation to the bottom of the flagstaff is α and that to the top of the flagstaff is β . Prove that the height of the tower BC is $\frac{x \tan \alpha}{\tan \beta - \tan \alpha}$



Section c: Multiple choice

Q1 A quadrilateral with diagonals intersecting at right angles is-
 a) a rectangle b) a parallelogram c) a kite d) all of the above

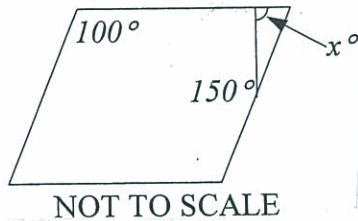
Q2 John has to load 1 tonne of potatoes onto a truck. When he has loaded 50kg, what percentage of the job has he finished?
 a) 0.05% b) 0.5% c) 5% d) 50%

Q3 Simplify $25\text{cm}^2 : 30\text{mm}^2$
 a) 25:3 b) 25:30 c) 5:6 d) 250:3

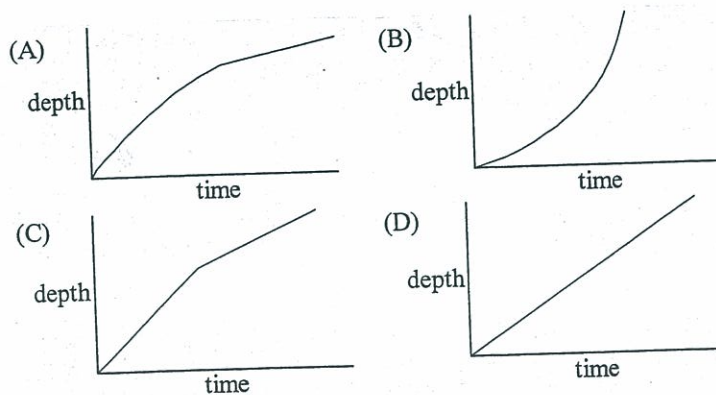
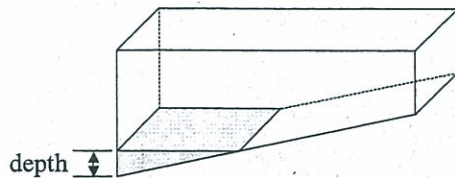
Q4 30% of 5 hours 30minute is
 a) 1.59 hours b) 99 minutes c) 3.71 hours d) 1hour 30 minutes

Q5 The tax payable on taxable incomes in the range \$20 701 to \$38 000 is given by
\$3060 plus 34c for each \$1 over \$20 700
 How much tax does Theresa pay if her taxable income is \$29 700?
 a) \$2960.72 b) \$6020.72 c) \$9998.72 d) \$13 058.72

Q6 The figure is a parallelogram, what is the value of x
 a) 50 b) 30 c) 90 d) 70



Q7 This swimming pool has sloping bottom. Water is flowing into the pool at a constant rate. Which graph best illustrate the change in the depth of water with time?

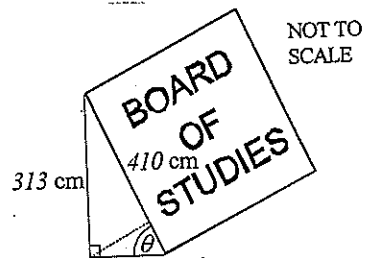


Q8 The value of x in the equation

$$\frac{2}{15} = \frac{1}{8} + \frac{1}{x}$$

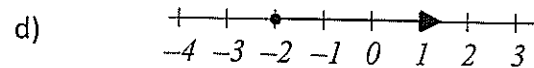
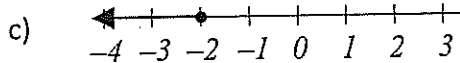
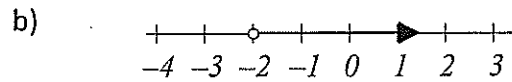
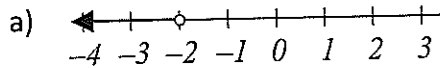
- a) $\frac{15}{8}$ b) $\frac{1}{7}$ c) 120 d) $\frac{120}{31}$

Q9 The diagram shows a large sloping advertising board. Find the angle θ , to the nearest degree, between the board and the ground.



- a) 37° b) 40° c) 50° d) 53°

Q10 The graph that illustrate the solution of $-3x > 6$ is



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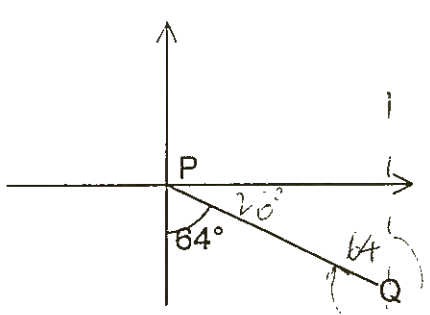
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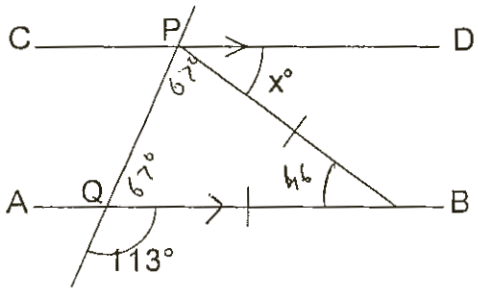
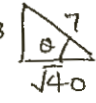
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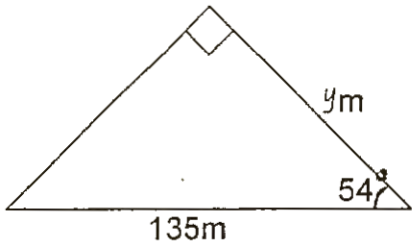
PART C:

- 10 multiple choice questions. CIRCLE the letter for the correct answer.

Section A: Short Answer Questions.

Question	Answer
<p>Q1 Evaluate $\frac{23 \times \sqrt{27.2}}{56 - 1.7^2}$ correct to 3 significant figures.</p>	<p>2.259 ✓ 2.26 ✗</p>
<p>Q2 What is the true bearing of P from Q.</p> 	<p>296°T OR N64W ✓ 134</p>
<p>Q3 A clothing company offers a discount of 12% off the regular price to its employees. If an employee pays \$110 for a suit, what is the regular price for the suit?</p>	<p>88% = 110 1% = $\frac{110}{88}$ 100% = $\frac{110 \times 100}{88}$ = 125 ✓</p>
<p>Q4 Factorise $x^2 + 4x - 21$</p>	<p>$(x+7)(x-3)$ ✓</p>
<p>Q5 Write the equation of a line through (2, 3) parallel to the x - axis.</p>	<p>$y = 3$ ✓</p>
<p>Q6 Simplify $2p^2 \times 3p^3q^2$</p>	<p>$6p^5q^2$ ✓</p>
<p>Q7 Find the size of each interior angle of a regular 12 sided polygon.</p>	<p>150° ✓</p>

<p>Q8 Write the exact value of $\tan 45^\circ \times \cos 45^\circ$</p>	$1 \times \frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} \checkmark$
<p>Q9 If $x^2 - y^2 = 64$ and $x + y = 16$, then find the value of $x - y$.</p>	$(x+y)(x-y) = 64$ $16(x-y) = 64$ $x-y = 4 \checkmark$
<p>Q10 Solve for x $\cos x^\circ = \sin 35^\circ$</p>	$x + 35^\circ = 90^\circ$ $x = 55^\circ \checkmark$
<p>Q11 Solve the following inequality $3x - 29 \leq 4x + 12$</p>	$3x - 4x \leq 12 + 29$ $-x \leq 41$ $x \geq -41 \checkmark$
<p>Q12 Simplify $\sqrt{63} - \sqrt{28}$</p>	$3\sqrt{7} - 2\sqrt{7} = \sqrt{7} \checkmark$
<p>Q13 Simplify $(2 - 3x) - (5 - 4x)$</p>	$2 - 3x - 5 + 4x$ $-3 + x \checkmark$
<p>Q14 Find the value of x, no reason required</p> 	$x = 46^\circ \checkmark$
<p>Q15 If $\sin \theta = \frac{3}{7}$, find the exact value of $\tan \theta$.</p>	 $\tan \theta = \frac{3}{\sqrt{40}} \checkmark$

<p>Q16 Find the value of y, to two decimal places</p> 	$\cos 54^\circ = \frac{y}{135}$ $y = 135 \times \cos 54^\circ$ $= 79.35 \checkmark$
<p>Q17 A cube has the surface area of 150 cm^2. What is the side length of the cube?</p>	$6a^2 = 150$ $a^2 = 25$ $a = 5 \checkmark$
<p>Q18 If $5^k(5^2)^3 = 1$, find k.</p> $5^k \times 5^6 = 1 \Rightarrow 5^{k+6} = 5^0$ $k+6=0$	$k = -6 \checkmark$

Section B: Show all necessary working in the space provided.

Question 1:

- (a) Solve the following equation $3x^2 = 2x + 2$ and write the answer as simplest surd form.

$$3x^2 - 2x - 2 = 0$$

$$x = \frac{2 \pm \sqrt{4 - 4 \times 3 \times -2}}{6} \checkmark$$

$$= \frac{2 \pm \sqrt{28}}{6}$$

$$= \frac{2 \pm 2\sqrt{7}}{6} = \frac{1 \pm \sqrt{7}}{3} \checkmark$$

- (b) Tickets for a river cruise cost \$15 for an adult and \$8 for a child. For one cruise, 46 tickets were sold and the money received for these was \$438. Form two equations and use them to find the number of adult tickets sold for the cruise.

$$\begin{array}{l} 15A + 8C = 438 \\ A + C = 46 \end{array} \checkmark$$

$$\begin{array}{l} 15A + 8C = 438 \\ 7A + 8C = 368 \end{array} \checkmark$$

$$7A = 70$$

$$A = 10 \checkmark$$

(c) Solve the following equation $\frac{2x-5}{3} - \frac{x+7}{5} = 2$

$$10x - 25 - 3x - 21 = 30 \quad \checkmark$$

$$7x - 46 = 30$$

$$7x = 76 \quad \checkmark$$

$$x = 10\frac{6}{7} \text{ or equivalent}$$

Question 2:

(a) Tina works in a restaurant and earns \$7.20 per hour at the normal rate. At present, each week, Tina works for 11 hours at the normal rate and 4 hours at time and a half.

(i) Find Tina's weekly wage.

$$\begin{aligned} \text{Her weekly wage} &= 11 \times 7.20 + 4 \times 7.20 \times 1.5 \quad \checkmark \\ &= \$122.40 \end{aligned}$$

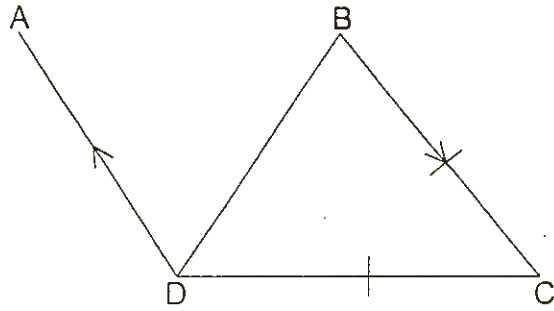
(ii) Tina wants to increase her weekly wage in part (i) to \$180 by working extra hours at normal rate. How many extra hours must Tina work?

$$\begin{cases} 180 = 122.40 + x \times 7.20 & \text{where } x \text{ is the no.} \\ & \text{of normal hrs.} \\ x = 8 \text{ h} \quad \checkmark \end{cases}$$

(iii) Tina's hourly rate is increased by 6%. Find the new hourly rate for normal hours, to the nearest cent.

$$\begin{aligned} \text{New rate} &= \frac{106}{100} \times 7.20 \\ &= \$7.63 \quad \checkmark \end{aligned}$$

(b) $AD \parallel BC$ and $BC = DC$. Prove that BD bisects $\angle ADC$, giving reasons.



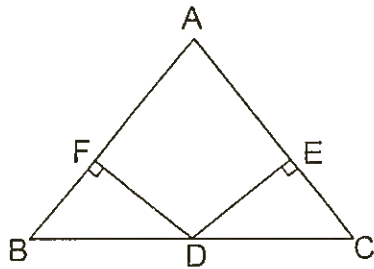
$$\angle CDB = \angle CDB \text{ (base } \angle \text{ of iso } \triangle \text{ are } =) \checkmark$$

$$\text{Also } \angle ADB = \angle CDB \text{ (alt. } \angle \text{ s on } AB \parallel BC \text{ are } =) \checkmark$$

$$\therefore \angle CDB = \angle ADB$$

Hence BD bisects $\angle ADC$ } ①

(c) If the mid-point D of the base BC of a triangle ABC is equidistant from its other sides. Prove that the triangle ABC is isosceles.



In $\triangle FBD$ & $\triangle DEC$

$$\angle DFB = \angle DEC = 90^\circ \text{ (given)}$$

$$BD = DC \text{ (D is the mid pt of BC)}$$

$$DF = DE \text{ (D is equidistant from AB \& AC)}$$

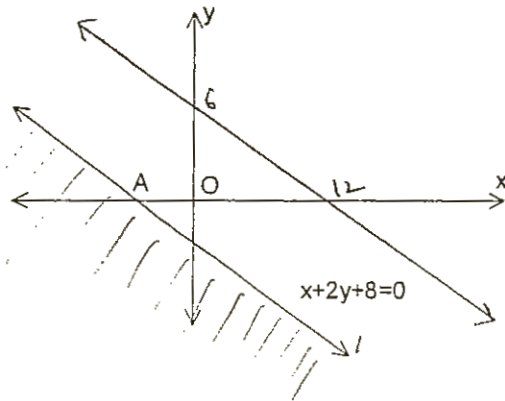
$$\therefore \triangle BDF \cong \triangle DEC \text{ (RHS)} \text{ --- ①}$$

$$\therefore \angle ABD = \angle ACD \text{ (matching parts of } \cong \triangle \text{ are } =) \text{ --- ②}$$

But these are the base \angle s of $\triangle ABC$ } --- ③
Hence ABC is an iso \triangle .

Question 3:

The line l is shown in the diagram. It has equation $x + 2y + 8 = 0$ and cut the



x-axis at A. The line k has the equation $y = -\frac{1}{2}x + 6$, and is not shown on the diagram.

- (i) Find the coordinates of A

$$x + 2(0) + 8 = 0$$

$$x = -8$$

$$\therefore A(0, -8) \checkmark$$

- (ii) Explain why k is parallel to l .

$$\text{eq of } l = -\frac{1}{2}x + 6$$

$$\therefore m_1 = -\frac{1}{2}$$

$$\text{eq of } k = x + 2y + 9 = 0$$

$$2y = -x + 9$$

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

$$\therefore m_2 = -\frac{1}{2}$$

Since $m_1 = m_2 \therefore l \parallel k$

- (iii) Draw the graph of k on your diagram, indicating where it cuts the axes. ① with the intercepts
- (iv) Shade the region $x + 2y + 8 \leq 0$ on your diagram — ①

- (v) Show that $P(8, 2)$ lies on k .

$$y = -\frac{1}{2}x + 6$$

$$2 = -\frac{1}{2} \times 8 + 6$$

$$-4 + 6$$

$$2 = 2 \checkmark$$

Hence $(8, 2)$ lies on k .

①

6

Question 4:

- (a) Given that x varies directly as y and inversely as z ; and that $x = 8$ when $y = 10$ and $z = 15$. Find x if $y = 4$ and $z = 3$.

$$x \propto \frac{y}{z} \quad x = \frac{ky}{z} \quad \text{--- (1)}$$

$$8 = \frac{k \times 10}{15}$$

$$\therefore k = 12 \quad \text{--- (2)}$$

$$x = \frac{12 \times 4}{3} = 16 \quad \text{--- (3)}$$

- (b) Find the equation of this circle with the diameter OA

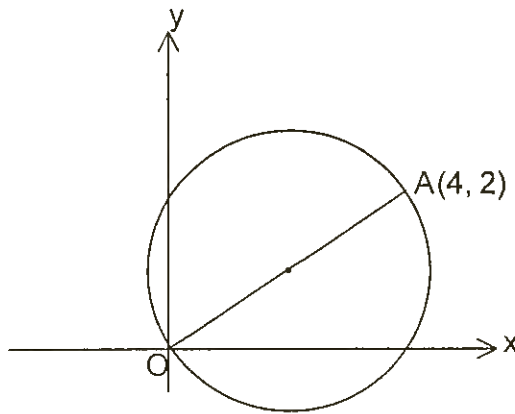
$$\text{Centre } \left(\frac{4+0}{2}, \frac{2+0}{2} \right) = (2, 1) \quad \text{--- (1)}$$

$$\text{Diameter is } \sqrt{(4-0)^2 + (2-0)^2} = \sqrt{16+4} = \sqrt{20}$$

$$\therefore \text{radius} = \frac{\sqrt{20}}{2} \text{ or } \sqrt{5}$$

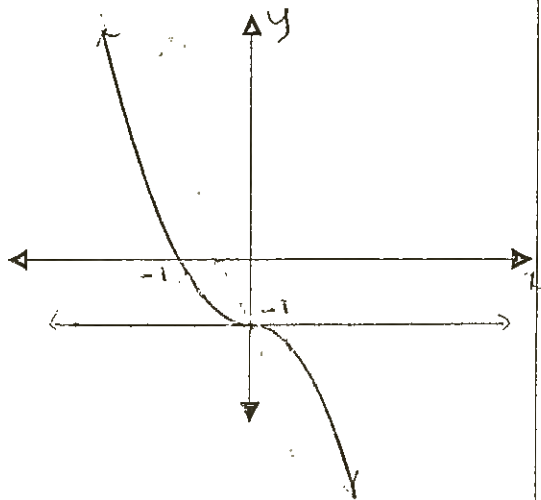
Hence the eq. of circle is

$$(x-2)^2 + (y-1)^2 = 5 \quad \text{--- (2)}$$



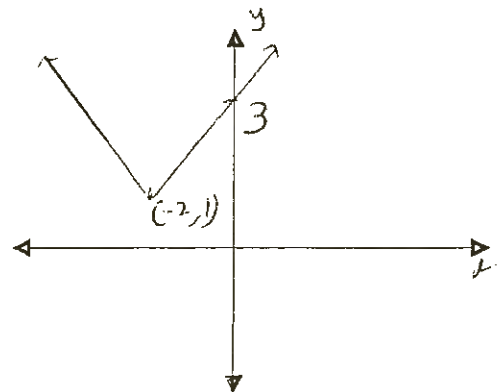
- (c) Sketch the graph of the following showing all the important features.

(i) $y = -\frac{1}{x^3} - 1$



- ① Shape
- ① x int
- ① y int

(ii) $y = |x + 2| + 1$



- ① Shape
- ① vertex
- ① intercepts

Question 5:

(a) Simplify, leaving your answer without negative indices

$$\frac{x^{-2} - y^{-2}}{x^{-1} + y^{-1}}$$

$$\frac{\frac{1}{x^2} - \frac{1}{y^2}}{\frac{1}{x} + \frac{1}{y}} \quad \text{--- (2)}$$

$$\frac{\frac{y^2 - x^2}{x^2 y^2}}{\frac{y+x}{xy}} = \frac{(y-x)(y+x)}{x^2 y^2} \times \frac{xy}{(y+x)} \quad \text{--- (1)}$$

$$= \frac{y-x}{xy} \quad \text{--- (1)}$$

(b) Find a and b if $\frac{2\sqrt{5}}{3\sqrt{5}+4} = a+b\sqrt{5}$

LHS $\frac{2\sqrt{5}}{3\sqrt{5}+4} \times \frac{3\sqrt{5}-4}{3\sqrt{5}-4} \quad \text{--- (1)}$ (3)

$$\frac{6 \times 5 - 8\sqrt{5}}{(3\sqrt{5})^2 - 4^2} = \frac{30 - 8\sqrt{5}}{29} = \frac{30}{29} - \frac{8}{29}\sqrt{5} = a + b\sqrt{5}$$

$$\therefore a = \frac{30}{29} \quad \text{--- (1)}$$

$$b = \frac{-8}{29} \quad \text{--- (1)}$$

(c) The circumference of a circle increases from π units to 2π units. What increase occurs in its area?

$$C = 2\pi r = \pi$$

$$2r = 1$$

$$r = \frac{1}{2}$$

$$\therefore A = \pi r^2 = \pi \times \frac{1}{4}$$

Circumference in inc. to 2π
 $2\pi r = 2\pi$
 $r = 1$ (1) for working
 $A = \pi \times 1^2 = \pi$ (2)
 or 4 times
 Hence by $\frac{3\pi}{4}$ area is increased.
 or 2.356... (1)

(d) If $\frac{3a+4b}{2a-2b} = 5$, then find value of $\frac{a^2+2b^2}{ab}$

$$3a+4b = 10a-10b$$

$$10a-3a = 4b+10b$$

$$7a = 14b$$

$$a = 2b$$

Sub. $a=2b$ in $\frac{a^2+2b^2}{ab}$

$$\therefore \frac{(2b)^2 + 2b^2}{2b \times b} = \frac{4b^2 + 2b^2}{2b^2}$$

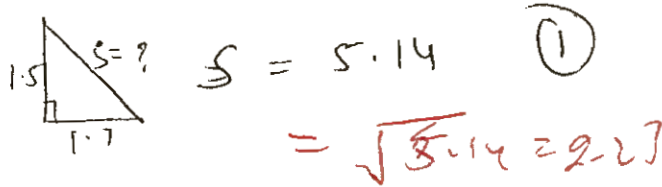
$$= \frac{6b^2}{2b^2} = 3 \quad \text{--- (1)}$$

8

12

Question 6:

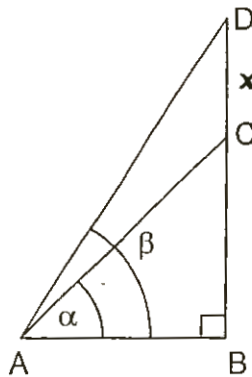
- (a) A solid cone has a diameter of 3.4 cm and perpendicular height of 1.5cm. Calculate to 2 decimal place
 (i) the slant height.



- (ii) the surface area of the cone.

$$\begin{aligned}
 S.A &= \pi r^2 + \pi r s \\
 &= \pi \times (1.7)^2 + \pi \times 1.7 \times \sqrt{5.14} \\
 &= \cancel{36.5304} \dots \\
 &= 21.20
 \end{aligned}$$

- (b) A vertical tower BC stands on horizontal plane and is surmounted by a vertical flagstaff DC of height x. At a point on the plane, the angle of elevation to the bottom of the flagstaff is α and that to the top of the flagstaff is β . Prove that the height of the tower BC is $\frac{x \tan \alpha}{\tan \beta - \tan \alpha}$



In $\triangle ABC$
 $\tan \alpha = \frac{BC}{AB}$
 $AB = \frac{BC}{\tan \alpha}$

In $\triangle ADB$
 $\tan \beta = \frac{BC+x}{AB}$
 $AB = \frac{BC+x}{\tan \beta}$

$$\therefore \frac{BC}{\tan \alpha} = \frac{BC+x}{\tan \beta} \quad (1)$$

$$\begin{aligned}
 BC \tan \beta &= \tan \alpha (BC + x) \\
 BC \tan \beta - BC \tan \alpha &= x \tan \alpha \\
 BC (\tan \beta - \tan \alpha) &= x \tan \alpha \\
 BC &= \frac{x \tan \alpha}{\tan \beta - \tan \alpha}
 \end{aligned}$$

Section c: Multiple choice

Q1 A quadrilateral with diagonals intersecting at right angles is-
 a) a rectangle b) a parallelogram **(c)** a kite d) all of the above

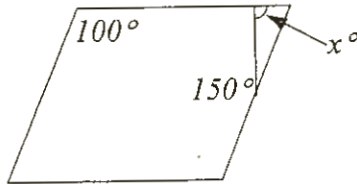
Q2 John has to load 1 tonne of potatoes onto a truck. When he has loaded 50kg, what percentage of the job has he finished?
 a) 0.05% b) 0.5% **(c)** 5% d) 50%

Q3 Simplify $25\text{cm}^2 : 30\text{mm}^2$.
 a) 25:3 b) 25:30 c) 5:6 **(d)** 250:3

Q4 30% of 5 hours 30minute is
 a) 1.59 hours **(b)** 99 minutes c) 3.71 hours d) 1hour 30 minutes

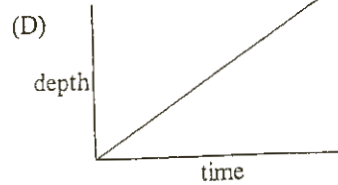
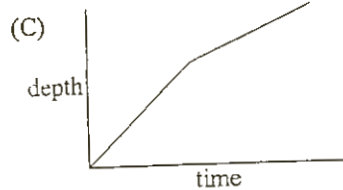
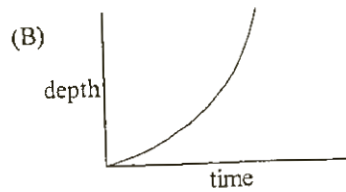
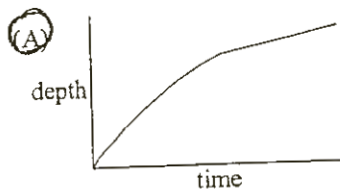
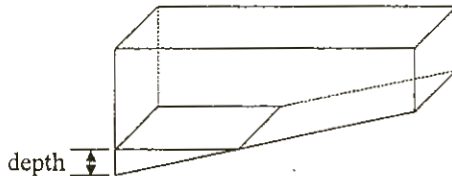
Q5 The tax payable on taxable incomes in the range \$20 701 to \$38 000 is given by
 $\$3060 \text{ plus } 34c \text{ for each } \$1 \text{ over } \$20\,700$
 How much tax does Theresa pay if her taxable income is \$29 700?
 a) \$2960.72 **(b)** \$6020.72 c) \$9998.72 d) \$13 058.72

Q6 The figure is a parallelogram, what is the value of x
 a) 50 b) 30 c) 90 **(d)** 70



NOT TO SCALE

Q7 This swimming pool has sloping bottom. Water is flowing into the pool at a constant rate. Which graph best illustrate the change in the depth of water with time?

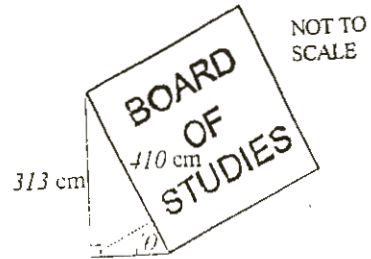


Q8 The value of x in the equation .

$$\frac{2}{15} = \frac{1}{8} + \frac{1}{x}$$

- a) $\frac{15}{8}$ b) $\frac{1}{7}$ c) 120 d) $\frac{120}{31}$

Q9 The diagram shows a large sloping advertising board. Find the angle θ , to the nearest degree, between the board and the ground.



- a) 37° b) 40° c) 50° d) 53°

Q10 The graph that illustrate the solution of $-3x > 6$ is

