HILLGROVE
SECONDARY SCHOOL

END OF YEAR EXAMINATION 2014

Secondary 3 Express

MATHEMATICS **4016/01**

PAPER 1

29September 2014

TIME: 7.50 a.m. — 9.20 a.m. DURATION: 1 hour 30minutes

INSTRUCTIONS TO STUDENTS:
Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Answer **all** questions.

If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in loss of marks.
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 60.

Name of Student: _____ ( )

Class: _____

Parent's Signature: _____

For Examiner's Use

60

Setter: MdmTeh GL

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi rl$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Answer **all** questions.

1. **(a)** Evaluate $\dfrac{\sqrt{8.64}}{23(7.28-9.15)}$, giving your answer correct to 2 significant figures.

Answer (a) _____ [2]

(b) Write the following in order of size, starting with the smallest.

35% $\quad \dfrac{3}{5} \quad$ $0.3\dot{5}$ $\quad 3^{\frac{1}{5}}$

Answer (b) _____, _____, _____, _____ [2]

---

2. **(a)** Simplify $\left(\dfrac{64}{125x^6}\right)^{-\frac{2}{3}}$.

Answer (a) _____ [1]

(b) Given that $a^5 \times a \div \sqrt{a} = a^k$, find the value of k.

Answer (b) _____ [1]

---

3. (a) Factorisefully $24ax - y + 8yx - 3a$.

Answer (a) _____ [2]

(b) Simplify $(2a-1)^2 - 9a^2$.

Answer (b) _____ [2]

(c) Express as a single fraction in its simplest form

$$\frac{x-7}{2x^2-5x+3} - \frac{7}{1-x}$$

Answer (c) _____ [2]

(d) Given that $k = 3\pi\sqrt{\frac{s}{t}}$, express t in terms of π, k and s.

Answer (d) _____ [2]

4. Solve the equation $\frac{4}{x-1}+\frac{5}{x-2}=9$, giving your answers correct to two decimal places.

Answer _____ [3]

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5. Given $\mathbf{P}=\begin{pmatrix}2 & 5\\ 0 & 0\end{pmatrix}$, $\mathbf{Q}=\begin{pmatrix}7 & 3\\ 0 & 2\end{pmatrix}$ and $\mathbf{S}=\begin{pmatrix}0 & x\\ 0 & \frac{1}{5}\end{pmatrix}$, find

(a) $\mathbf{P}^2$,

Answer (a) _____ [1]

(b) **PQ**,

Answer (b) _____ [1]

(c) the matrix **R** such that $2\mathbf{P}-\mathbf{R}=\mathbf{Q}$,

Answer (c) _____ [2]

(d) the value of x given that **PS** is the zero matrix.

Answer (d) _____ [1]

---

6. (a) Solve the inequality $11 > \frac{8x+1}{3} \geq \frac{1-2x}{4}$.

Answer (a) _____ [2]

(b) Write down the greatest and least integers which satisfy $11 > \frac{8x+1}{3} \geq \frac{1-2x}{4}$.

Answer (b) Greatest=_____Least=_____ [2]

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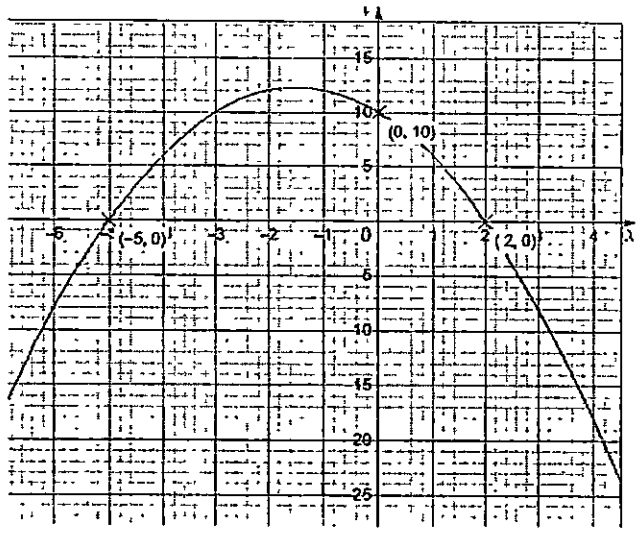
7. The diagram below shows the graph of $y = px^2 + qx + r$.
Find the values



(a) p,

Answer (a) _____ [1]

(b) q,

Answer (b) _____ [1]

(c) r.

Answer (c) _____ [1]

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8. Madam Aini is a well-known pineapple tarts baker. She wants to sell her pineapple tarts during the Hari Raya season in the school canteen. The fixed costs are $210. The cost for making each pineapple tart is $0.50. She wants to sell them at $1.20 each.

(a) Calculate the number of pineapple tarts that need to be made and sold in order to break even.

Answer (a) _____ [2]

(b) (i) Find the difference between her expenses and her income if 400 pineapple tarts were made.

Answer (b)(i) $_____ [1]

(ii) Hence, state if it is a loss or a profit for Madam Siti to make 400 pineapple tarts.

Answer (b)(ii) _____ [1]

9. John wants to save $1000 in a bank for two years. He has two banks to consider, namely PowDow Bank and Bibi Bank.

(a) Calculate how much savings John has at the end of 2 years if he were to save at PowDow Bankthat pays 5% simple interest per annum, and at Bibi Bank that pays 8% per annum compounded quarterly.

Answer (a) PowDow Bank = $_____

Bibi Bank = $_____ [3]

(b) Explain which is a better bank for John to save his $1000.

Answer (b) _____ [1]

_____

_____

_____

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10. **(a)** Given the line $2y-5x-12=0$, find the equation of another straight line passing through the point (2, 9) and having the same gradient as $2y-5x-12=0$.

Answer (a) _____ [2]

(b) If the distance between the points $A(p, 2)$ and $B(2, p)$ is $\sqrt{32}$, find the possible values of p.

Answer (b) _____ [2]

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11. Mr Tan bought an ELKO handbag for S$450. Six months later, he sold it for a profit of 250%. Find

(a) the selling price in Singapore dollars,

Answer (a) $_____ [1]

(b) the distance Mr Tan travelled to sell the handbag if it took him 2 hours 17 minutes at an average speed of 80 km/h,

Answer (b) _____km [1]

(c) the profit earned in nearest US dollars if Mr Tan exchanged the profit earned in Singapore dollars using the exchange rate of US$1 = S$1.26.

Answer (c) US$_____ [1]

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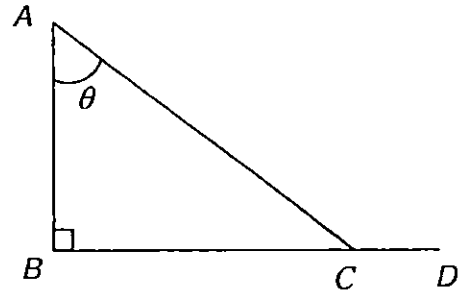
12. In the triangle ABC, angle $ABC=90^o$ and BC is produced to $D$and $\sin\theta = \frac{4}{5}$.

Calculate



(a) $\cos(180^o - \theta)$,

Answer (a) _____ [1]

(b) $\sin\angle DCA$,

Answer (b) _____ [1]

(c) the perpendicular distance from B to AC, given that $AC = 5$ cm.

Answer (c) _____ [2]

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13. A road is represented by a length of 4.6 cm on map A and 5.75 cm on map B.
Map A has a scale of $2 : x$ while map B has a scale of $1 : y$.

(a) Find $x : y$.

Answer (a) _____ [2]

(b) Hence, calculate the actual area covered by the road in km^2 which is represented by 7.2 cm^2 on map A if $y = 125\,000$.

Answer (b) _____ [2]

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14. MrsKoh bought two geometrically similar cylinder shaped toy containers for her daughters.
The smaller model has a height of 6 cm while the larger model has a height of 10 cm.
Find

(a) the surface area of the smaller model given that the surface area of the larger model is 80 cm^2,

Answer (a) _____ cm^2 [2]

(b) the mass of the larger model given that the smaller model has a mass of 540 g.

Answer (b) _____ g [2]

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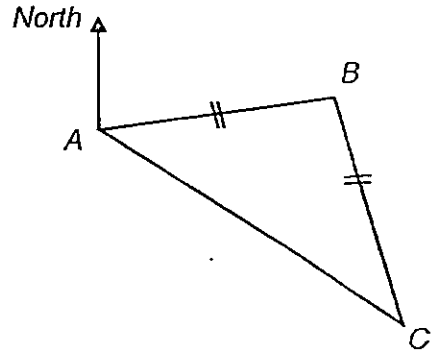
15. A, B, C are three points on level ground and $AB=BC$. The bearing of B from A is 065^o and the bearing of C from A is 120^o.
Find



(a) the bearing of A from B,

Answer (a) _____ ° [1]

(b) $\angle ABC$,

Answer (b) _____ ° [1]

(c) the bearing of A from C,

Answer (c) _____ ° [1]

(d) the area of the triangle ABC if AB=10 cm.

Answer (d) _____ cm^2 [1]

End of Paper 1

HILLGROVE
SECONDARY SCHOOL

END OF YEAR EXAMINATION 2014

Secondary 3 Express

MATHEMATICS **4016/02**

PAPER 2

26September 2014

TIME: 7.50 a.m. — 9.50 a.m. DURATION: 2 hours

ADDITIONAL MATERIALS: Foolscap paper andGraph Paper

INSTRUCTIONS TO STUDENTS:
Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Answer **all** questions.

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You are expected to use a scientific calculator to evaluate explicit numerical expressions.
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For π, use your calculator unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

Name of Student: _____ ( )

Class: _____

Parent's Signature: _____

For Examiner's Use

80

Setter: MdmTeh GL

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi rl$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

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$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Answer **all** questions.

1. **(a)** Simplify $\frac{5x^2-20}{x^2+x-2} \div \frac{3(x-2)^3}{x-1}$. [2]

(b) Given the mean of 10, $2x$, $2y$, 15 and 30 is 25. Find the mean of $3x$ and $3y$. [2]

(c) Solve $4^{3m+1} \times 16 = 2\left(8^{m-1}\right)$. [2]

(d) y is directly proportional to $\frac{1}{x^2}$. x is decreased by 10%. Find the percentage increase in y. [2]

(e) Raisin buns are sold in packs of 24. Kaya buns are sold in packs of 150. Meimei buys the same number of raisin and kaya buns. Find the least number of packsof kaya buns that Meimei could have bought. [2]

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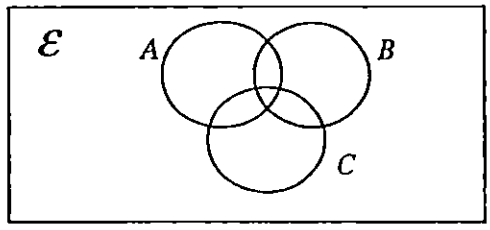
2. **(a)** $\varepsilon = \{x : x \text{ is an integer such that } 1 < x \leq 15\}$
$A = \{x : x \text{ is an integer divisible by 2}\}$
$B = \{x : x \text{ is a factor of 24}\}$

(i) Draw a Venn Diagram to illustrate this information. [1]

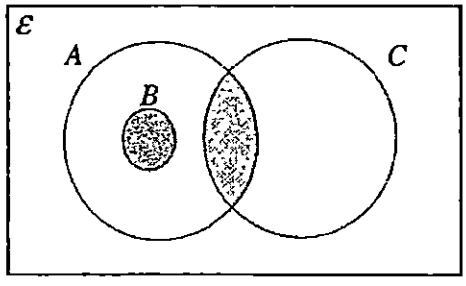
(ii) List the elements contained in the set $A' \cup B$. [1]

(iii) Write down $n(A \cap B)'$. [1]

(b) For the given diagram below, shade the region representing $(A \cup B) \cap C'$. [1]



(c) For the given diagram below, express in set notation the set represented by the shaded area in terms of A, B and C. [1]



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3. A rice supplier sells four types of rice to three supermarkets every month.

Name of Supermarket \ Type of rice	Number of kg per delivery			
	White	Brown	Red	Glutinous
NTUC	30	12	12	18
Cold Storage	25	15	16	14
Giant	28	10	12	24

The cost per kilogram for white rice is \$5.50, brown rice is \$7.00, red rice is \$7.80, and glutinous rice is \$4.30.

(a) Write down two matrices such that the elements of their product under matrix multiplication will give the total cost price of the rice delivered to each different supermarket in a month. [3]
Hence, evaluate this total cost.

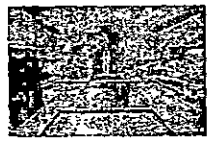
(b) [2]
If $\mathbf{P}=\begin{pmatrix} 30 & 12 & 12 & 18 \\ 25 & 15 & 16 & 14 \\ 28 & 10 & 12 & 24 \end{pmatrix}$ and $\mathbf{Q}=\begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$, evaluate **PQ**.
Describe what is represented by the elements of **PQ**.

(c) The rice supplier intends to make a profit of 5% from NTUC, 8% from Cold Storage and 3% from Giant. Form two matrices such that the product will give the new selling price to each different supermarket. [2]

4.

Great Singapore SALE !

Order Your New kitchen cabinet set at **$2400** as shown.



Hire Purchase is available !
20% Down Payment
36 monthly instalments Only!!

Mrs Tan decided to buy a kitchen cabinet set that was priced at $2400 by hire purchase. She paid a 20% deposit and the rest by 36 monthly instalments. If she paid $2745.60 altogether, calculate

(a) the monthly instalment, [2]

(b) the interest she paid, [1]

(c) the interest rate per annum that was charged, [2]

(d) the percentage of money she would have saved by paying cash given that if she had bought the kitchen cabinet set by paying cash, a discount of 10% would have been given. Give your answer correct to the nearest percent. [2]

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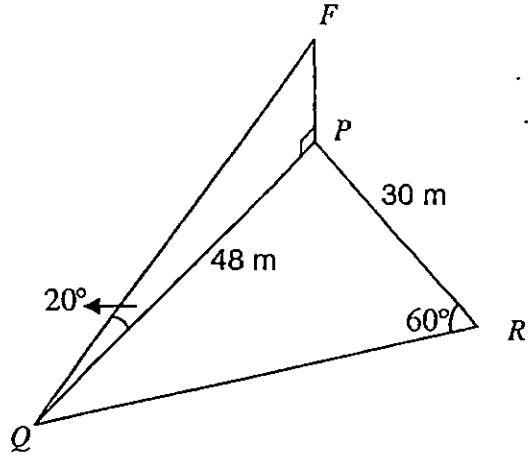
5. The diagram shows PQR as a triangular field on horizontal ground. F is the top of a vertical flagpole FP. $PQ = 48$ m, $PR = 30$ m and $\angle PRQ = 60°$. The angle of elevation of the top of the pole from Q is $20°$.



(a) Calculate

(i) the height of the flagpole, [2]

(ii) $\angle PQR$, [2]

(iii) the area of the field PQR. [2]

(b) Tod walks from R towards Q until he reaches a point M where PM is minimum. Find the distance of PM. [2]

(c) Calculate the greatest angle of elevation of the top of the pole when viewed from any point on QR. [2]

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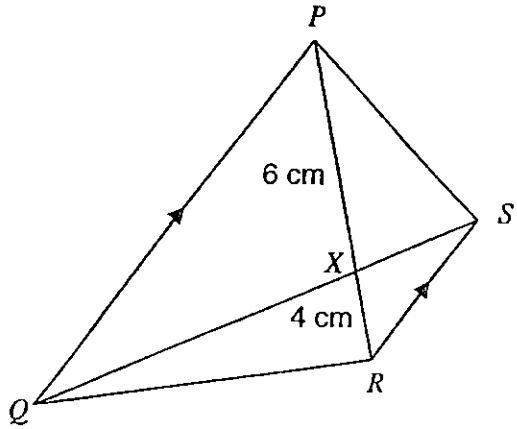
6. $PQRS$ is a quadrilateral with QP parallel to RS. PR and QS meet at X. RX=4 cm and PX= 6 cm.



(a) Prove that ΔPXQ is similar to ΔRXS. [3]

(b) If QS= 20 cm, find the length of QX. [2]

(c) Find $\frac{\text{Area of triangle } QXR}{\text{Area of triangle } PXS}$. [2]

(d) Find $\frac{\text{Area of triangle } PXQ}{\text{Area of triangle } RXS}$. [1]

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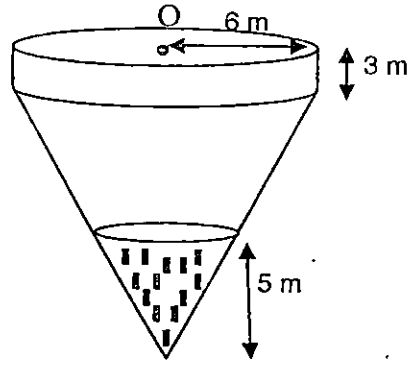
7. A special water container is made by joining together a cylinder of radius 6 m and a cone with a base radius of 6 m as shown in the diagram below. The height of the cylinder is 3m. The point O is the centre of the base of the cone.

Calculate



(a) the volume of the cylinder, [2]

(b) the height of the cone if the total volume of the water container is 600 m^3, [2]

(c) the radius of the water surface if water is poured into the container to a height of 5 m, [2]

(d) thevolume of the empty space of the container above the liquid. [2]

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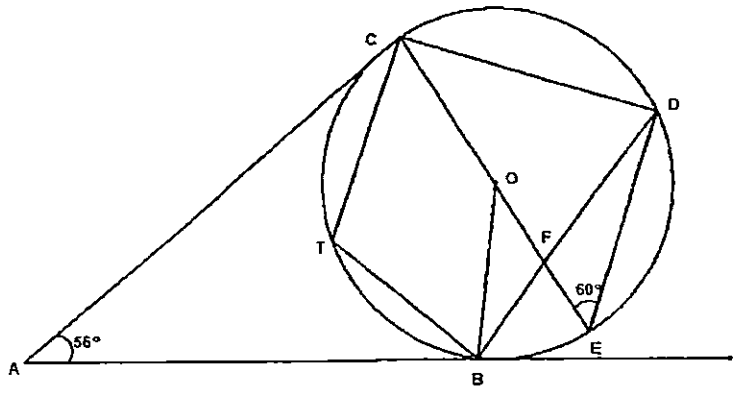
8. The circle $EDCTB$ has centre O. AC and AB are tangents to the circle. $COFE$ and BFD are straight lines. $\angle DEC = 60°$ and $\angle BAC = 56°$.



(a) Prove that ΔACO is congruent to ΔABO. [3]

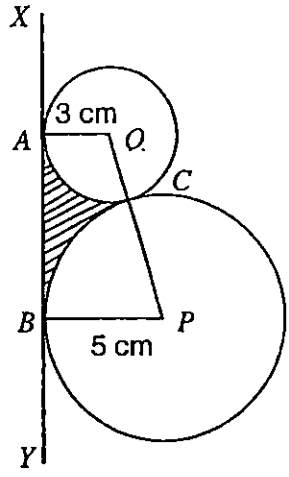
(b) Find with geometrical reasons,

(i) Obtuse $\angle BOC$, [1]
(ii) $\angle BDC$, [1]
(iii) $\angle OFD$, [1]
(iv) $\angle CTB$, [2]
(v) $\angle ECD$. [1]

---

9. The diagram shows two circles, with centres P and Q, touching each other at C. The radius of circle, with centre P is 5 cm and the radius of circle with centre Q is 3 cm. XY is a straight wall that the two circles touched at point A and B respectively.

Calculate



(a) the length of AB, [2]

(b) the angle $\angle BPC$ in radians, [2]

(c) the perimeter of the shaded region, [2]

(d) the area of the shaded region. [2]

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10. Hilly Condominium has a swimming pool that holds 36 tonnes of water. The water needs to be pumped out totally for cleaning every six months.

(a) If "Pipa" pump is used, it can pump out x tonnes of water per minute. [1]
Write down an expression, in terms of x, for the number of minutes it takes to empty the swimming pool.

(b) However, if "Gini" pump is used; it can pump out 4tonnes more of water per minute. [1]
Write down an expression, in terms of x, for the number of minutes it takes to empty the swimming pool.

(c) It takes 2 minutes longer to empty the swimming pool using "Pipa" pump than "Gini" pump. [3]
Write down an equation in x and show that it reduces to
$x^2 + 4x - 72 = 0$.

(d) Solve the equation $x^2 + 4x - 72 = 0$. [2]

(e) Find the time taken, in minutes and seconds, correct to the nearest seconds, to empty the swimming pool using "Gini" pump. [1]

End of Paper 2

Answer **all** questions.

1. (a) Evaluate $\dfrac{\sqrt{8.64}}{23(7.28-9.15)}$, giving your answer correct to 2 significant figures.

$= -0.068341959$ (M1)

≈ -0.068 (A1)

Answer (a) -0.068 [2]

(b) Write the following in order of size, starting with the smallest.

35%	$\frac{3}{5}$	$0.3\dot{5}$	$3^{\frac{1}{5}}$
0.350	0.600	$0.3\dot{5}$	1.245 (M1)
35%	0.35	$\frac{3}{5}$	$3^{\frac{1}{5}}$ (A1)

Answer (b) $35\%,\ 0.3\dot{5},\ \frac{3}{5},\ 3^{\frac{1}{5}}$ [2]

---

2. (a) Simplify $\left(\dfrac{64}{125x^6}\right)^{-\frac{2}{3}}$.

$= \left(\dfrac{125x^6}{64}\right)^{\frac{2}{3}} = \dfrac{5^{3\times\frac{2}{3}}x^{6\times\frac{2}{3}}}{4^{3\times\frac{2}{3}}}$

$= \dfrac{5^2x^4}{4^2}$

$= \dfrac{25}{16}x^4$ or $1\dfrac{9}{16}x^4$ (B1)

Answer (a) $\frac{25}{16}x^4$ or $1\frac{9}{16}x^4$ [1]

(b) Given that $a^5 \times a \div \sqrt{a} = a^k$, find the value of k.

$a^5 \times a^1 \div a^{\frac{1}{2}} = a^k$

$a^{5+1-\frac{1}{2}} = a^k$

$5+1-\frac{1}{2} = k$

$\therefore k = 5\frac{1}{2}$ (B1)

Answer (b) $5\frac{1}{2}$ [1]

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(3) → shifted → done in latest list

3. (a) Factorise fully $24ax - y + 8yx - 3a$.

$= 24ax + 8yx - 3a - y$

$= 8x(3a + y) - (3a + y)$ (M1)

$= (3a + y)(8x - 1)$ (A1)

Answer (a) $(3a + y)(8x - 1)$ [2]

(b) Simplify $(2a-1)^2 - 9a^2$.

$= (2a-1)^2 - (3a)^2$

$= [2a - 1 - 3a][2a - 1 + 3a]$ (M1)

$= (-a - 1)(5a - 1)$ (A1)

OR $4a^2 - 4a + 1 - 9a^2$

$= -5a^2 - 4a + 1$ (M1)

$= (-a - 1)(5a - 1)$ (A1)

Answer (b) $(-a-1)(5a-1) = -5a^2 - 4a + 1$ [2]

(c) Express as a single fraction in its simplest form

$$\frac{x-7}{2x^2-5x+3} - \frac{7}{1-x}$$

$2x^2 - 5x + 3$: $2x \times x$, -3×-1, $-3x - 2x = -5x$

$= \frac{x-7}{(2x-3)(x-1)} + \frac{7}{(x-1)}$

$= \frac{x-7}{(2x-3)(x-1)} + \frac{7(2x-3)}{(2x-3)(x-1)}$ (M1) able to factorise & correct denominator

$= \frac{x - 7 + 7(2x-3)}{(2x-3)(x-1)}$

$= \frac{x - 7 + 14x - 21}{(2x-3)(x-1)}$

$= \frac{15x - 28}{(2x-3)(x-1)}$ (A1)

Answer (c) $\frac{15x-28}{(2x-3)(x-1)}$ [2]

(d) Given that $k = 3\pi\sqrt{\frac{s}{t}}$, express t in terms of π, k and s.

$\frac{k}{3\pi} = \sqrt{\frac{s}{t}}$

$\frac{k^2}{9\pi^2} = \frac{s}{t}$ (M1)

$t = \frac{9\pi^2 s}{k^2}$ (A1)

Answer (d) $t = \frac{9\pi^2 s}{k^2}$ [2]

4. Solve the equation $\frac{4}{x-1}+\frac{5}{x-2}=9$, giving your answers correct to two decimal places.

$\frac{4(x-2)+5(x-1)}{(x-1)(x-2)} = 9$

$4x-8+5x-5 = 9(x-1)(x-2)$

$9x-13 = 9(x^2-2x-x+2)$

$9x-13 = 9x^2-27x+18$

$0 = 9x^2-36x+31$ (A1)

$a=9,\ b=-36,\ c=31$

$x = \frac{-(-36)\pm\sqrt{(-36)^2-4(9)(31)}}{2(9)}$ (M1)

$x = \frac{36\pm\sqrt{1296-1116}}{18}$

$x = \frac{36\pm\sqrt{180}}{18}$

$x = 2.7453$ or $x = 1.2546$

$x = 2.75$ or $x = 1.25$ (2dp) (A1)

Answer $x=2.75$ or $x=1.25$ (M1) [3] both answers

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5. Given $\mathbf{P}=\begin{pmatrix}2 & 5\\ 0 & 0\end{pmatrix}$, $\mathbf{Q}=\begin{pmatrix}7 & 3\\ 0 & 2\end{pmatrix}$ and $\mathbf{S}=\begin{pmatrix}0 & x\\ 0 & \frac{1}{5}\end{pmatrix}$, find

(a) $\mathbf{P}^2$,

$= \begin{pmatrix}2 & 5\\ 0 & 0\end{pmatrix}\begin{pmatrix}2 & 5\\ 0 & 0\end{pmatrix}$

$= \begin{pmatrix}4 & 10\\ 0 & 0\end{pmatrix}$ (B1)

Answer (a) $\begin{pmatrix}4 & 10\\ 0 & 0\end{pmatrix}$ [1]

(b) $\mathbf{PQ}$,

$\begin{pmatrix}2 & 5\\ 0 & 0\end{pmatrix}\begin{pmatrix}7 & 3\\ 0 & 2\end{pmatrix}$

$= \begin{pmatrix}14 & 16\\ 0 & 0\end{pmatrix}$ (B1)

Answer (b) $\begin{pmatrix}14 & 16\\ 0 & 0\end{pmatrix}$ [1]

(c) the matrix $\mathbf{R}$ such that $2\mathbf{P}-\mathbf{R}=\mathbf{Q}$,

$2\begin{pmatrix}2 & 5\\ 0 & 0\end{pmatrix}-R=\begin{pmatrix}7 & 3\\ 0 & 2\end{pmatrix}$

$R = -2\begin{pmatrix}2 & 5\\ 0 & 0\end{pmatrix}-\begin{pmatrix}7 & 3\\ 0 & 2\end{pmatrix} = \begin{pmatrix}-3 & 7\\ 0 & -2\end{pmatrix}$ (M1) (A1)

Answer (c) [2]

(d) the value of x given that $\mathbf{PS}$ is the zero matrix.

$\begin{pmatrix}2 & 5\\ 0 & 0\end{pmatrix}\begin{pmatrix}0 & x\\ 0 & \frac{1}{5}\end{pmatrix} = \begin{pmatrix}0 & 0\\ 0 & 0\end{pmatrix}$

$2x+1=0$

$\therefore x=-\frac{1}{2}$ (B1)

Answer (d) [1]

---

6. (a) Solve the inequality $11 > \frac{8x+1}{3} \geq \frac{1-2x}{4}$.

$11 > \frac{8x+1}{3}$ $\quad \frac{8x+1}{3} \geq \frac{1-2x}{4}$

$33 > 8x+1$ $\quad \frac{4(8x+1)}{12} \geq \frac{3(1-2x)}{12}$

$32 > 8x$ $\quad 4(8x+1) \geq 3(1-2x)$

$4 > x$ (either) (M1) $\quad 32x+4 \geq 3-6x$

$32x+6x \geq 3-4$

$38x \geq -1$

$x \geq \frac{1}{38}$

$\therefore -\frac{1}{38} \leq x < 4$ (A1)

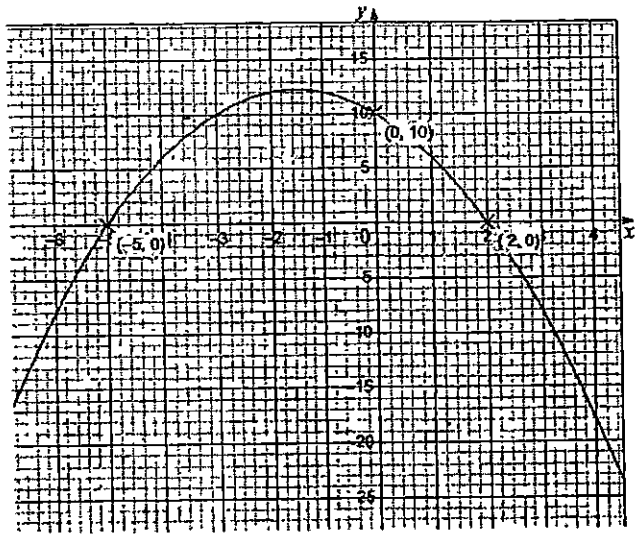
Answer (a) $-\frac{1}{38} \leq x < 4$ [2]

(b) Write down the greatest and least integers which satisfy $11 > \frac{8x+1}{3} \geq \frac{1-2x}{4}$.

Answer (b) Greatest= 3 (B1) Least= 0 (B1) [2]

---

7. The diagram below shows the graph of $y = px^2 + qx + r$.
Find the values



(a) p,

Answer (a) -1 [1]

(b) q,

Answer (b) -3 [1]

(c) r.

Answer (c) 10 [1]

---

8. Madam Aini is a well-known pineapple tarts baker. She wants to sell her pineapple tarts during the Hari Raya season in the school canteen. The fixed costs are $210. The cost for making each pineapple tart is $0.50. She wants to sell them at $1.20 each.

(a) Calculate the number of pineapple tarts that need to be made and sold in order to break even.

Let x be the number of pineapple tarts

Expenses = Income

$210 + 0.5x = 1.2x$ (M1)

$210 = 1.2x - 0.5x$

$0.7x = 210$

$x = \frac{210}{0.7}$

$x = 300$ (A1)

Answer (a) 300 [2]

(b) (i) Find the difference between her expenses and her income if 400 pineapple tarts were made.

Expenses in making 400 pineapple tart

$= \$210 + 400(0.5)$

$= \$210 + \$200$

$= \$410$

Income from selling 400 tart

$= 400 \times 1.20$

$= \$480$

Answer (b)(i) $ 70 [1]

(ii) Hence, state if it is a loss or a profit for Madam Siti to make 400 pineapple tarts.

Answer (b)(ii) Profit [1]

9. John wants to save $1000 in a bank for two years. He has two banks to consider, namely PowDow Bank and Bibi Bank.

(a) Calculate how much savings John has at the end of 2 years if he were to save at PowDow Bank that pays 5% simple interest per annum, and at Bibi Bank that pays 8% per annum compounded quarterly.

PowDow Bank

$I = \frac{PRT}{100} = \frac{1000 \times 5 \times 2}{100}$ (M1)

$= \$100$

At end of 2 years = $1100 ← (A1) → $A = \$1171.66$

for both answers

Bibi Bank

$A = 1000\left(1 + \frac{8}{4 \times 100}\right)^{8}$ (M1)

$A = 1171.6593$

Answer (a) PowDow Bank = $ 1100

Bibi Bank = $ 1171.66 [3]

Accept $1170 (3sf)

(b) Explain which is a better bank for John to save his $1000.

Answer (b) Bibi bank is a better bank for John to save his money as he gets more interest. [1]

---

10. **(a)** Given the line $2y - 5x - 12 = 0$, find the equation of another straight line passing through the point (2, 9) and having the same gradient as $2y - 5x - 12 = 0$.

$2y = 5x + 12$

$y = \frac{5}{2}x + 6$ M1 (A1) for gradient $= \frac{5}{2}$

$y = \frac{5}{2}x + c$

$9 = \frac{5}{2}(2) + c$

$c = 4$

$\therefore y = \frac{5}{2}x + 4$ (A1)

Answer (a) $y = \frac{5}{2}x + 4$ [2]

(b) If the distance between the points $A(p, 2)$ and $B(2, p)$ is $\sqrt{32}$, find the possible values of p.

$AB = \sqrt{(p-2)^2 + (2-p)^2} = \sqrt{32}$ (M1)

$(p-2)^2 + (2-p)^2 = 32$

$p^2 - 4p + 4 + 4 - 4p + p^2 = 32$

$2p^2 - 8p + 8 = 32$

$2p^2 - 8p - 24 = 0$

$p^2 - 4p - 12 = 0$

$(p+2)(p-6) = 0$

$p = -2$ or $p = 6$ (A1) for both answers

Answer (b) $p = -2$ or $p = 6$ [2]

---

11. Mr Tan bought an ELKO handbag for S$450. Six months later, he sold it for a profit of 250%.
Find

(a) the selling price in Singapore dollars,

100% → $450
350% → $\frac{450}{100} \times 350 = \$1575$ (B1)

Answer (a) $ 1575 [1]

(b) the distance Mr Tan travelled to sell the handbag if it took him 2 hours 17 minutes at an average speed of 80 km/h,

$D = S \times T$
$= 80 \times 2\frac{17}{60}$
$= 80 \times \frac{137}{60} = \frac{548}{3} = 182\frac{2}{3}$ km (B1)

Answer (b) $182\frac{2}{3}$ km [1]

(c) the profit earned in nearest US dollars if Mr Tan exchanged the profit earned in Singapore dollars using the exchange rate of US$1 = S$1.26.

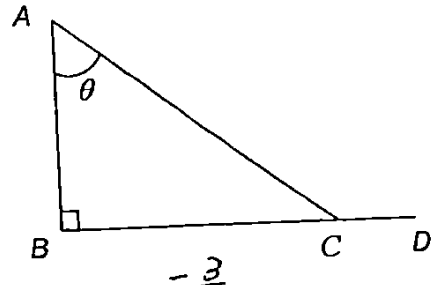
S$1.26 → US$1
S$1125 → $\frac{1}{1.26} \times 1125$
$= 892.8571$
≈ US$893 (B1)

Answer (c) US$ 893 [1]

---

12. In the triangle ABC, angle $ABC = 90^\circ$ and BC is produced to D and $\sin\theta = \frac{4}{5}$.

Calculate



(a) $\cos(180^\circ - \theta)$,

$= -\cos\theta$
$= -\frac{3}{5}$ (B1)

Answer (a) $-\frac{3}{5}$ [1]

(b) $\sin\angle DCA$,

$= \sin\angle BCA$
$= \frac{3}{5}$ (B1)

Answer (b) $\frac{3}{5}$ [1]

(c) the perpendicular distance from B to AC, given that $AC = 5$ cm.

Area of $\Delta ABC = \frac{1}{2} \times 3 \times 4$ (M1)
$= 6\ cm^2$
Let perpendicular distance be h
$\frac{1}{2} \times h \times 5 = 6$
$h = \frac{6 \times 2}{5} = \frac{12}{5} = 2\frac{2}{5}$ cm (A1)

Answer (c) $2\frac{2}{5}$ cm [2]

---

13. A road is represented by a length of 4.6 cm on map A and 5.75 cm on map B.
Map A has a scale of 2 : x while map B has a scale of 1: y.

(a) Find $x : y$.

$\frac{2}{x} = 4.6$ | $\frac{1}{y} = 5.75$ | $\therefore x : y = 10 : 4$

$x = \frac{2}{4.6}$ | $y = \frac{1}{5.75}$ | $x : y = 5 : 2$ (A1)

$x = \frac{10}{23}$ | $y = \frac{4}{23}$ |

(M1)

OR Let z be the actual length.

$\frac{2}{x} = \frac{4.6}{z}$, $\frac{1}{y} = \frac{5.75}{z}$

$z = \frac{4.6x}{2}$, $\frac{1}{y} = \frac{5.75}{2.3x}$

$z = 2.3x$, $\therefore \frac{x}{y} = \frac{5}{2}$

$\therefore \frac{1}{y} = \frac{5.75}{z}$ $\therefore x : y = 5 : 2$

Answer (a) 5 : 2 [2]

(b) Hence, calculate the actual area covered by the road in km^2 which is represented by 7.2 cm^2 on map A if y = 125 000.

Area Scale : $4 : x^2$

$4 \to x^2$

$7.2 \text{ cm}^2 \to \frac{x^2}{4} \times 7.2$

$= 1.8x^2$

$\frac{x}{y} = \frac{5}{2}$

If $y = 125000$, $\frac{x}{125000} = \frac{5}{2}$

$x = 312500$ (A1)

Actual area in cm^2

$= 1.8(312500)^2$

$= 1.757812 \times 10^{11}$ cm^2

1 km^2 = $(100000)^2$ cm^2

$\therefore$ Actual area in km^2

$= \frac{1.757812 \times 10^{11}}{10^{10}}$

$= 17.6 \text{ km}^2$ (A1)

or $17\frac{37}{64}$ km^2

Answer (b) $17\frac{37}{64}$ [2]

---

14. Mrs Koh bought two geometrically similar cylinder shaped toy containers for her daughters. The smaller model has a height of 6 cm while the larger model has a height of 10 cm.
Find

(a) the surface area of the smaller model given that the surface area of the larger model is 80 cm^2,

$\frac{A_1}{A_2} = \frac{6^2}{10^2}$

$\frac{A_1}{80} = \frac{3^2}{5^2}$ (M1)

$A_1 = \frac{9}{25} \times 80 = 28.8 \text{ cm}^2$ (A1)

Answer (a) 28.8 cm^2 [2]

(b) the mass of the larger model given that the smaller model has a mass of 540 g.

$\frac{V_1}{V_2} = \frac{l_1^3}{l_2^3}$

$\frac{540}{V_2} = \frac{3^3}{5^3}$ (M1)

$27V_2 = 5^3 \times 540$

$V_2 = \frac{5^3 \times 540}{27}$

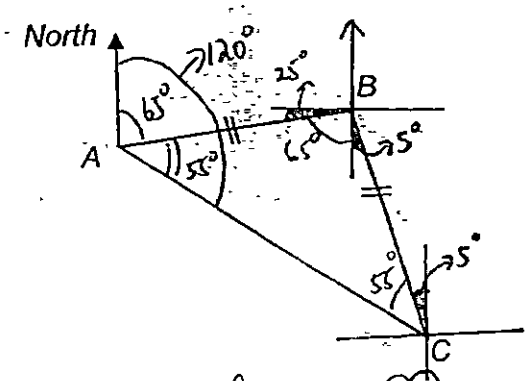
$V_2 = 2500$ (A1)

Answer (b) 2500 g [2]

---

15. A, B, C are three points on level ground and $AB = BC$. The bearing of B from A is 065° and the bearing of C from A is 120°.

End



(a) the bearing of A from B, $270° - 25° = 245°$ (B1)

Answer (a) 245 ° [1]

(b) $\angle ABC$,

$\angle BAC = 120° - 65°$
$= 55°$
$\therefore \angle ABC = 180° - 55° - 55° = 70°$ (B1)

Answer (b) 70 ° [1]

(c) the bearing of A from C,

$= 360° - 55° - 5°$
$= 300°$ (B1)

OR  $\therefore 360° - 60° = 300°$ (B1)

Answer (c) 300 ° [1]

(d) the area of the triangle ABC if $AB = 10$ cm.

Area $\triangle ABC = \frac{1}{2} ab \sin C$
$= \frac{1}{2} \times 10 \times 10 \times \sin 70°$
$= 46.9846$
$\approx 47.0 \text{ cm}^2$ (3 sf)

Answer (d) 47.0 cm^2 [1]

End of Paper 1

Paper 2 – Sec 3 Exp 2014

P2 – Marking Scheme

-1m for overall no 3sf.

1 a) $\frac{5x^2-20}{x^2+x-2} \div \frac{3(x-2)^3}{x-1}$

$= \frac{5(x^2-4)}{(x+2)(x-1)} \times \frac{(x-1)}{3(x-2)^3}$ (M1) able to factorize

$= \frac{5(x-2)(x+2)}{(x+2)(x-1)} \times \frac{(x-1)}{3(x-2)^3}$

$= \frac{5}{3(x-2)^2}$ (A1)

Allow if students expand

Ans: $\frac{5}{3x^2-12x+12}$

b) $\frac{10+2x+2y+15+30}{5} = 25$

$\frac{2x+2y+55}{5} = 25$

$2x+2y = 125-55$

$2x+2y = 70$

$x+y = 35$ (M1)

Mean of $3x+3y$ = ?

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

$= \frac{3(35)}{2}$

$\therefore$ Mean of $3x+3y = 52\frac{1}{2}$ (A1)

c) $4^{3m+1} \times 16 = 2(8^{m-1})$

$2^{2(3m+1)} \times 2^4 = 2^1 \times 2^{3(m-1)}$ (M1) able to find same base

$2(3m+1) + 4 = 1 + 3(m-1)$

$6m + 2 + 4 = 1 + 3m - 3$

$6m - 3m = 1 - 3 - 2 - 4$

$3m = -8$

$m = -2\frac{2}{3}$ (A1)

OR

$2^{2(3m+1)} \times \frac{16}{2} = 8^{3(m-1)}$

$2(3m+1) + 3 = 3(m-1)$

⋮

d) $y = \frac{k}{1x^2}$. x decreased by 10%

Method 1

$y = \frac{k}{(0.9x)^2}$ (M1)

$y = \frac{k}{x^2} \times \left(\frac{1}{0.81}\right)$

$y = \frac{k}{x^2} \times \frac{100}{81}$

$1 \longrightarrow 100\%$

$\frac{100}{81} \rightarrow \frac{100}{1} \times \frac{100}{81}$

$= 23\frac{37}{81}\%$

$\therefore$ % increase $= 23\frac{37}{81}\%$ (3sf) (A1)

Method 2

% increase $= \frac{\frac{100}{81}\left(\frac{k}{x^2}\right) - \frac{k}{x^2}}{\frac{k}{x^2}} \times 100\%$ (M1)

$= 23\frac{37}{81}\%$ (A1)

e) Raisin buns sold in packs of 24.

Kaya buns sold " " " 150.

$\therefore$ least number of packs of Kaya buns

$= 600 \div 150$

$= 4$ (A1)

$2 \mid 24, 150$

$2 \mid 12, 75$

$2 \mid 6, 75$

$3 \mid 3, 75$

$5 \mid 1, 25$

$5 \mid 1, 5$

$1, 1$

LCM of $24 \& 150 = 2^3 \times 3 \times 5^2$

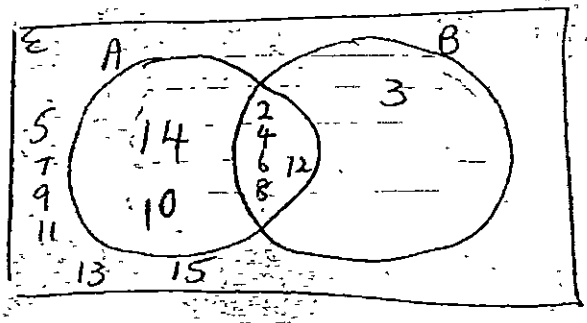
$= 600$ (A1)

2a) $\xi = \{2, 3, 4, \ldots 15\}$

$A = \{2, 4, 6, 8, 10, 12, 14\}$

$B = \{2, 3, 4, 6, 8, 12\}$

i)



(B1)

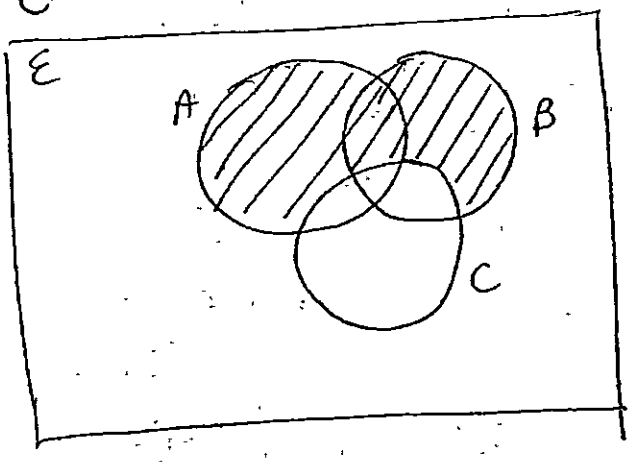
ii) $A' \cup B = \{2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 15\}$ ∈ no bracket, no marks

10

iii) $(A \cap B)' = \{3, 5, 7, 9, 11, 13, 14, 15\}$

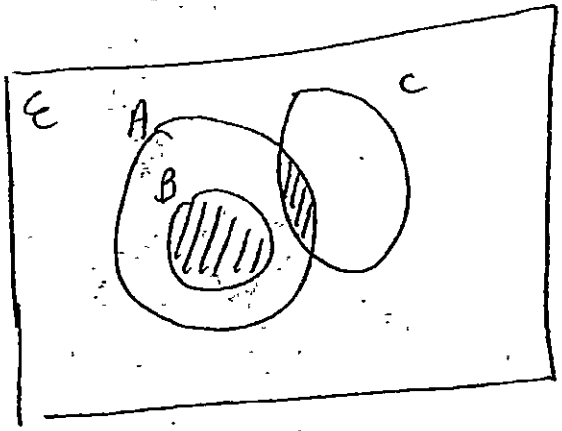
$n(A \cap B)' = 9$ (B1)

b) $(A \cup B) \cap C'$



(B1)

c)



$B \cup (A \cap C)$ or $A \cap (B \cup C$

(B1)

or $(A \cap B) \cup (A \cap C)$

a) $\begin{pmatrix} 30 & 12 & 12 & 18 \\ 25 & 15 & 16 & 14 \\ 28 & 10 & 12 & 24 \end{pmatrix} \begin{pmatrix} 5.50 \\ 7.00 \\ 7.80 \\ 4.30 \end{pmatrix} = \begin{pmatrix} 420 \\ 427.5 \\ 420.8 \end{pmatrix}$

3×4 (B1) $\quad 4\times1$ (B1) $\quad 3\times1$ (B1)

b) $\begin{pmatrix} 30 & 12 & 12 & 18 \\ 25 & 15 & 16 & 14 \\ 28 & 10 & 12 & 24 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$ (3×4, 4×1)

$\therefore PQ = \begin{pmatrix} 72 \\ 70 \\ 74 \end{pmatrix}$ (B1)

OR

$(5.50 \quad 7.00 \quad 7.80 \quad 4.30) \begin{pmatrix} 30 & 25 \\ 12 & 15 \\ 12 & 16 \\ 18 & 14 \end{pmatrix}$

$= (420 \quad 427.5 \quad 420.$

The element in PQ represents the total number of kilograms of the different types of rice delivered to the 3 different supermarkets. (B1)

Q 3c) $\begin{pmatrix} 1.05 & 0 & 0 \\ 0 & 1.08 & 0 \\ 0 & 0 & 1.03 \end{pmatrix} \begin{pmatrix} 420 \\ 427.5 \\ 420.8 \end{pmatrix} = \begin{pmatrix} 441.00 \\ 461.70 \\ 433.42 \end{pmatrix}$

3×3 (A1) $\quad 3\times1$ (A1)

OR

$\begin{pmatrix} 420 & 0 & 0 \\ 0 & 427.50 & 0 \\ 0 & 0 & 420.80 \end{pmatrix} \begin{pmatrix} 1.05 \\ 1.08 \\ 1.03 \end{pmatrix} = \begin{pmatrix} 441.00 \\ 461.70 \\ 433.42 \end{pmatrix}$

$3\times3 \quad 3\times1 \quad 3\times1$

$420 \quad 1 \quad 1.08 \quad 0$ (A1)

4 | Cash price = $2400

a) 20% deposit = $\frac{20}{100} \times 2400$

= $480.

$2745.60 - $480 = $2265.60

Monthly instalment = $\frac{2265.60}{36}$ (M1)

= $62.93 (A1)

b) Interest paid = $2745.60 − $2400

= $345.60 (B1)

c) Amount owed = $2400 − $480 = $1920

$I = \frac{PRT}{100}$ → method mark is given if this is wrong

$345.60 = \frac{1920 \times R \times 3}{100}$ (M1)

$R = 6\%$ (A1)

d) If paid by cash = $\frac{90}{100} \times 2400$

= $2160

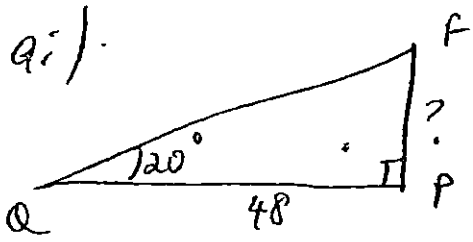
% of money she would have saved

= $\frac{\$2745.60 - \$2160}{\$2160} \times 100\%$ (M1)

= 27.111 %

≈ 27 % (nearest percent) (A1)

5) a) i)



Height of flagpole $(FP) = ?$

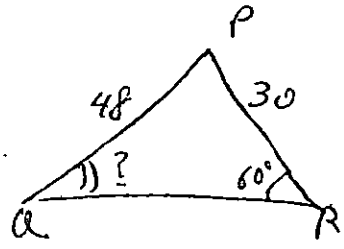
$$\tan 20^\circ = \frac{FP}{48} \quad (M1)$$

$$FP = 48 \tan 20^\circ$$

$$= 17.4705$$

$$\approx \underline{17.5\ m} \quad (A1)$$

ii) $\frac{30}{\sin \angle PQR} = \frac{48}{\sin 60}$



$$48 \sin \angle PQR = 30 \sin 60$$

$$\sin \angle PQR = \frac{30 \sin 60}{48} \quad (M1)$$

$$\angle PQR = \sin^{-1}\left(\frac{30 \sin 60}{48}\right)$$

$$= \sin^{-1}(0.541265)$$

$$= 32.7698^\circ$$

$$\angle PQR \approx \underline{32.8^\circ} \quad (A1)$$

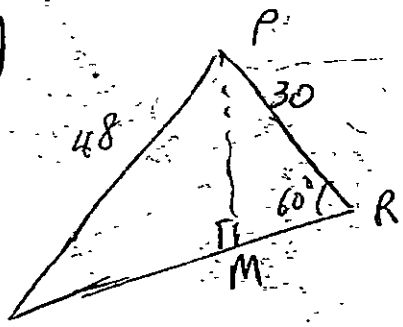
$\angle QPR = 180^\circ - 60^\circ - 32.7698^\circ = 87.2302^\circ$

iii) Area $PQR = \frac{1}{2} \times 48 \times 30 \times \sin(87.2302)$ (M1)

$$= 719.15885$$

$$\approx \underline{719\ m^2} \quad (A1)$$

b)



$\frac{QR}{\sin 87.2302} = \frac{48}{\sin 60}$

$QR = \frac{48 \times \sin 87.2302}{\sin 60}$

$QR = 55.36087$

$\frac{1}{2} \times QR \times PM = 719.1585$ (M1)

$\frac{1}{2} \times 55.36087 \times PM = 719.1585$

$27.6804 PM = 719.1585$

$PM = 25.9807$

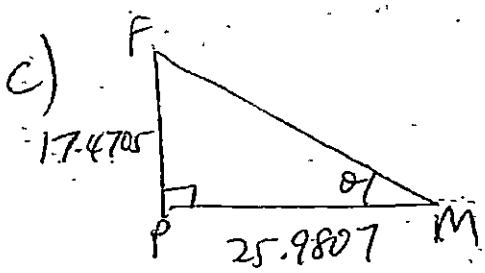
$PM \approx 26.0$ (3sf) (A1)

OR $\sin 60° = \frac{PM}{30}$

$PM = 25.9807$

$\therefore PM \approx 26.0$

c)



$\tan \theta = \frac{17.4705}{25.9807}$ (M1)

$\theta = \tan^{-1}\left(\frac{17.4705}{25.9807}\right)$

$\theta = 33.9185$

$\theta \approx 33.9°$ (A1)

Alternative method for (b)

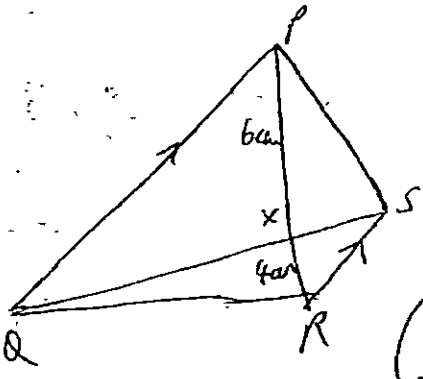
$\sin 60° = \frac{PM}{30}$

$PM = 30 \times \sin 60°$ (M1)

$PM = 25.980762\ldots$

≈ 26.0 m (to 3sf) (A1)

6)



$\frac{PXQ}{RXS}$

totally no reasons −1m

1 reason or 2 reasons −1m

a) [3] Prove that ΔPXQ is similar to ΔRXS.

* order is impt.

$\angle PXQ = \angle RXS$ (vert. opp. $\angle$) (M1)

$\angle QPX = \angle SRX$ (alt. $\angle$, $PQ \parallel RS$) (M1) any one

$\angle PQX = \angle RSX$ (alt. $\angle$, $PQ \parallel RS$)

$\therefore \Delta PXQ$ is similar to ΔRXS because their corresponding angles are the same. (A1)

* Students to note that order is impt in proof of congruency / similarity even on the proving step

b) [3]

Since ΔPXQ is similar to ΔRXS

$$\frac{QX}{SX} = \frac{PX}{RX}$$

$$\frac{QX}{SX} = \frac{6}{4}$$

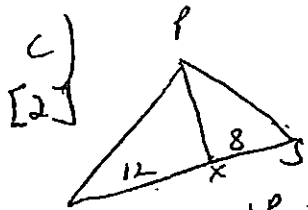
$$\frac{QX}{SX} = \frac{3}{2}$$

Since $QS = 20cm$

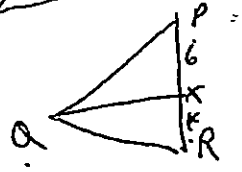
$QX = \frac{3}{5} \times 20$ (M1)

$QX = 12cm$ (A1)

c) [2]



$\frac{\text{area } \Delta PQX}{\text{area } \Delta PXS} = \frac{12}{8} = \frac{3}{2}$ (M1)



$\frac{\text{Area } \Delta QXR}{\text{Area } \Delta QXP} = \frac{4}{6} = \frac{2}{3}$

$\therefore \frac{\text{Area } \Delta QXR}{\text{Area } \Delta PXS} = \frac{2}{2} = 1$ (A1)

11 a.a. ΔPXQ $\lceil 6 \rceil^2$ $\lceil 3 \rceil^2$ 9 (1) Account $\frac{1}{2}$

7) a) Volume of cylinder $= \pi r^2 L$

$= \pi (6)^2 (3)$ (M1)

$= 339.292$

$\approx \underline{339\ m^3}$ (A1)

b) Total volume of container $= 600\ m^3$

$\therefore$ Vol of cone $= 600 - 339.292$

$= 260.708$ (M1)

$\frac{1}{3} \pi r^2 h = 260.708$

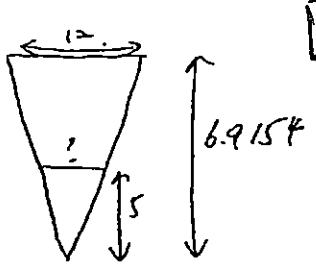
$\frac{1}{3} \pi (6)^2 h = 260.708$

$h = \frac{260.708 \times 3}{\pi (6)^2}$

$h = 6.9154$

$h \approx \underline{6.92\ m}$ (A1)

c)



Method 1:

$\frac{\text{Diameter of water surface}}{12} = \frac{5}{6.9154}$

Diameter of water surface $= \frac{5}{6.9154} \times 12$ (M1)

$= 8.67628$

$\therefore$ radius of water surface $= 4.33814$

≈ 4.34 (A1)

Method 2:

$\frac{\text{radius}}{6} = \frac{5}{6.91549}$

radius $= \frac{5}{6.91549} \times 6$ (M1)

$= 4.33808$

$\approx \underline{4.34M}$ (A1)

d) Vol of empty space of the container above the liquid

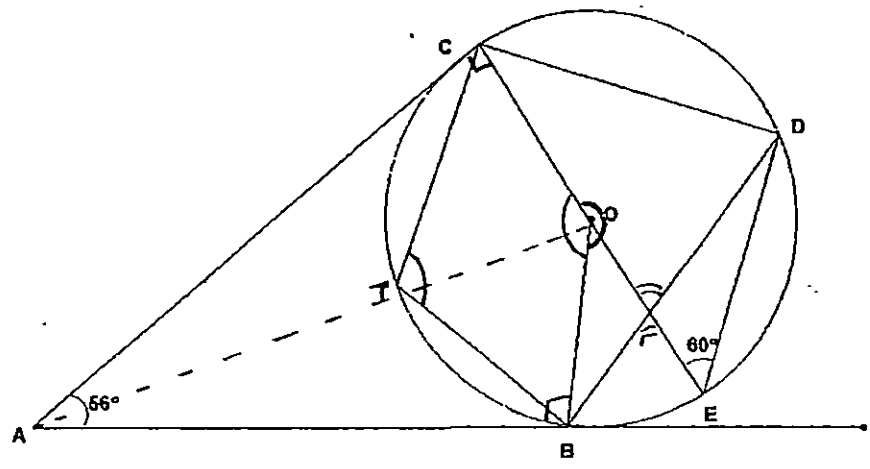
$= 600 - \frac{1}{3} \pi (4.3381)^2 (5)$ (M1)

$= 600 - 98.53663$

$= 501.46337$

$\approx \underline{501\ m^3}$ (B1) (A1)

Note: Deduct (2m) max. for overall question if no reasons were given.



a) [3] To prove $\triangle ACO$ is congruent to $\triangle ABO$.

$\angle ACO = \angle ABO = 90°$ (radius ⊥ tangent)

$AC = AB$ $OC = OB$ (radii of the same circle)

OA is common.

$\therefore$ By RHS, $\triangle ACO$ is congruent to $\triangle ABO$. (A1)

} if 1 reason or 2 reasons correct - no marks for conclusion. if all 3 reasons ✓

* Note: Accept by SAS or AAS methods as well.

bi) obtuse $\angle BOC = 2(90° - 28°)$

$90° < x < 180°$ $= 124°$ (B1) (since $\triangle ACO$ is congruent to $\triangle ABO$, $\angle AOC = \angle AOB$ and AO bisects $\angle CAB$.)

ii) $\angle BDC = 62°$ (B1) ($\angle$ at centre = 2 $\angle$ at $\odot^{ce}$)

iii) $\angle OFD = ?$

$\angle BOE = 180° - 124° = 56°$ (adj $\angle$s on a str. line)

$\angle BDE = 28°$ ($\angle$ at centre = 2 $\angle$ at $\odot^{ce}$)

$\therefore \angle OFD = 60° + 28°$ (ext $\angle$ of a $\triangle$)

$= 88°$ (B1)

iv) $\angle CTB =$ reflex $\angle BOC$ ($\angle$ at centre = 2 $\angle$ at $\odot^{ce}$)

$= \frac{360 - 124}{2}$ (M1)

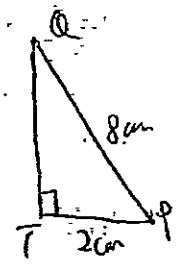
$= 118°$ (A1)

OR

$\angle CTB = 180° - 62°$ (M1) (∠s in opp segment)

$= 118°$ (A1)

a)

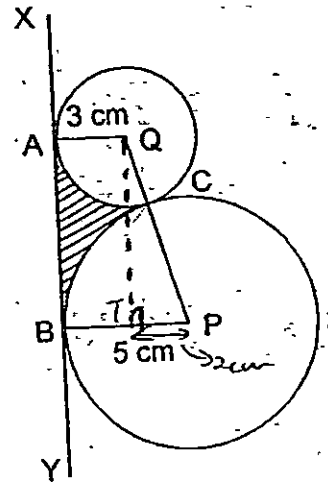


Length $AB = \sqrt{8^2 - 2^2}$ (M1)

$= \sqrt{60}$

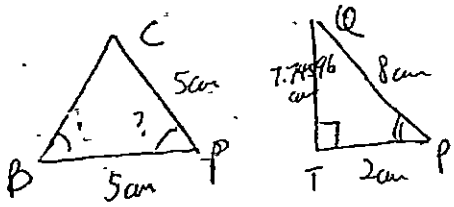
$= 7.74596$

$\approx 7.75\text{ cm}$ (A1)



If shown $\tan^{-1}\left(\frac{7.74596}{2}\right)$ – oh – 1m

b)



$\cos \angle TPQ = \frac{2}{8}$ (M1)

$\angle TPQ = \cos^{-1}\left(\frac{2}{8}\right)$

$\therefore \angle BPC = \angle TPQ = 1.3181$ (B1) (A1)

$= 1.32$ rad

OR $\frac{\sin \angle BPC}{7.74596} = \frac{\sin \frac{\pi}{2}}{8}$ ← radian

c) $\angle PQA = 2\pi - \frac{\pi}{2} - \frac{\pi}{2} - 1.3181$

$= 1.82349$

If 2 correct – 1m

$\therefore$ Perimeter of shaded region = AB + length of minor arc AC + length of minor arc BC (m)

$= 7.74596 + (3 \times 1.82349) + (5 \times 1.3181)$

$= 7.74596 + 5.47047 + 6.5905$

$= 19.80693$

$\approx 19.8\text{ cm}$ (3sf) (A1)

d) Area of shaded region

= Area of trapezium ABPQ – Area of minor sector QAC – Area of minor sector PBC (m1)

$= \frac{1}{2} \times 7.74596 \times (3+5) - \left(\frac{1}{2} \times 3^2 \times 1.82349\right) - \left(\frac{1}{2} \times 5^2 \times 1.3181\right)$

$= 30.98384 - 8.205705 - 16.47625$

$= 6.301885$

$\approx 6.30\text{ cm}^2$ (A1)

a) Pipa Pump

x tonnes → 1 min

36 tonnes → $\frac{1}{x} \times 36$

$= \frac{36}{x}$ mins (B1)

b) Giri Pump:

$x+4$ → 1 min

36 tonnes → $\frac{1}{x+4} \times 36$

$= \frac{36}{x+4}$ mins (B1)

c) [3]

$\frac{36}{x} - \frac{36}{x+4} = 2$ (M1)

$\frac{36(x+4) - 36x}{x(x+4)} = 2$

$36x + 144 - 36x = 2x(x+4)$ (M1)

$144 = 2x^2 + 8x$

$2x^2 + 8x - 144 = 0$

$\therefore x^2 + 4x - 72 = 0$ (A1)

d) [2]

$x^2 + 4x - 72 = 0$

$a = 1, b = 4, c = -72$

$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-72)}}{2(1)}$ (M1)

$x = \frac{-4 \pm \sqrt{16 + 288}}{2}$

$x = \frac{-4 \pm \sqrt{304}}{2}$

$x = \frac{-4 + \sqrt{304}}{2}$ or $x = \frac{-4 - \sqrt{304}}{2}$

$x = 6.71779$ or $x = -10.71779$

$x \approx 6.72$ (A1) or $x = -10.7$ (A1) (3 sf)

If both answers did not round to 3sf, just minus 1m

e) Giri pump:

Time taken to empty swimming pool: $\frac{36}{6.71779 + 4}$

$= \frac{36}{10.71779}$

$= 3.3589$

$= 3$ mins 21.534 secs

≈ 3 mins 22 secs (B1)