3Exp

KRANJI SECONDARY SCHOOL

END-OF-YEAR EXAMINATION 2021

MATHEMATICS 4048
PAPER 1

Level : Secondary Three

Stream : Express

Name : ____________________________ (   )

Class : Secondary ___________

Date : 1st October 2021

Duration : 2 hr

Total Marks Obtained : ____ / 80

READ THESE INSTRUCTIONS FIRST:

Do not open this question paper until you are told to do so.

Write your name, class and register number in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

Give non-exact numerical answers correct to three significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is **80**.

Set by: Mr Aziz

This Question Paper consists of 17 printed pages, including the cover page.

[Turn over

Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

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

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

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

Trigonometry

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

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

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer **all** the questions.

1 **(a)** Calculate $\left[30.763+0.78\times\frac{35}{72}\right]\div\sqrt{\frac{111}{1250}}$.

Write down the first 8 digits of your answer.

Answer .... [1]

(b) Write your answer to **part (a)** correct to 2 decimal places.

Answer .... [1]

2 The number of people who attended the National Day Parade 2019 is stated as 26700, correct to 3 significant figures.

(a) What is the smallest possible number of people at the Parade?

Answer .... [1]

(b) What is the largest possible number of people at the Parade?

Answer .... [1]

3 **(a)** Express 270 as a product of its prime factors.

Answer .... [1]

(b) Written as a product of its prime factors, $378 = 2 \times 3^3 \times 7$.
Find the HCF of 270 and 378.

Answer .... [1]

(c) Given that $y = 378k$, find the smallest integer k such that y is a perfect square.

Answer $k =$................................ [1]

---

4 Factorise completely.

(a) $xy - y + 1 - x$

Answer .... [2]

(b) $2p^3 - 50p$

Answer .... [2]

---

5 (a) Express $\frac{3x}{2x-4y}+\frac{2}{2y-x}$ as a single fraction in its simplest term.

Answer .... [2]

(b) Find the value of $\frac{x}{y}$ if $\frac{7x-3y}{3}=\frac{3x+4y}{4}$.

Answer .... [2]

6 (a) Solve the inequality $3x-1\leq\frac{x}{2}<1-x$.

Answer .... [2]

(b) Illustrate the solution set on the number line below. [1]

(c) Write down the largest integer value of x that satisfies the inequality.

Answer .... [1]

7 Make q the subject of the formula $p = \dfrac{1}{1-q} - 1$.

Answer q = ... [3]

---

8 **(a)** Simplify $\dfrac{p^2}{2q^4} \div \dfrac{\sqrt{}}{(4q^3)^2}$.

Answer .... [3]

(b) Given that $\left(\dfrac{1}{7}\right)^k = 343 \div 49^k$, find the value of k.

Answer k = ... [2]

---

9 A map is drawn to a scale of 1 : 1000.

(a) Find, the actual distance, in kilometres, between two cities given that they are 8 cm apart on the map.

Answer .... km [2]

(b) Find the actual area, in square kilometres, of a city which has an area of 50 cm^2 on the map.

Answer .... km^2 [2]

10 Mr Tan purchased an apartment which was advertised at \$850 000. He paid a deposit of 40%, and the balance was paid with a bank loan.

(a) The bank charged a simple interest of 2% per annum for the loan balance. Find the total interest charged if the loan repayment period was 15 years.

Answer \$................................ [2]

(b) Mr Tan's budget for his loan repayment every month is \$3700.

Will he exceed his budget? Give a reason for your answer using relevant working.

Answer ....

.... [3]

11 The diagram shows a restaurant bill. The total amount paid was \$58.85.

Quantity	Item	Amount
4	Set Meal A	\$ $4x$
Subtotal		\$ $4x$
Service Charge (10%)		\$ y
GST (7%)		\$ z
Total		\$ 58.85

(a) Find the GST that is levied on the subtotal & the service charge.

Answer z = ... [1]

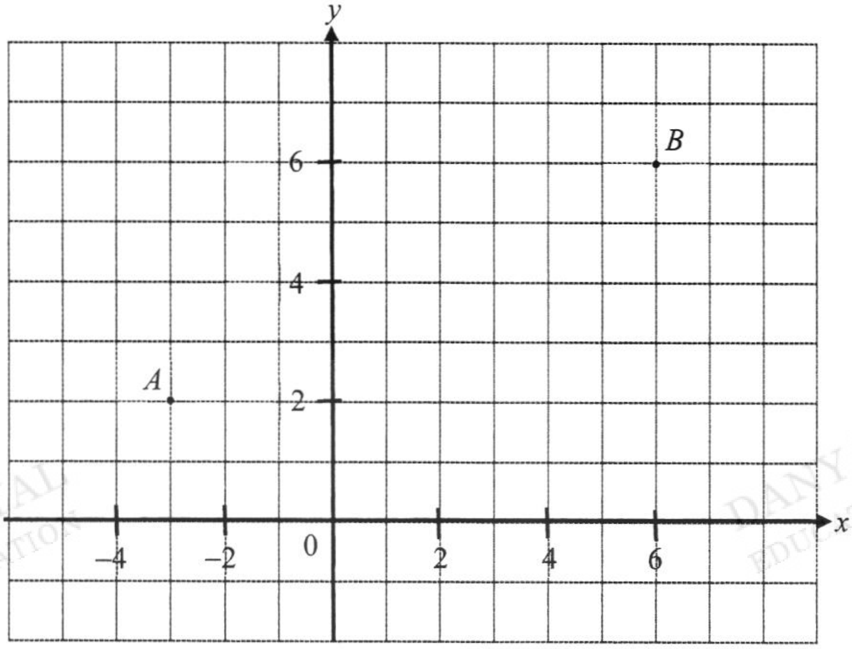
(b) Find the service charge.

Answer y = ... [1]

(c) Hence, find the cost of each set meal A.

Answer x = ... [1]

12 The diagram shows two points $A(-3, 2)$ and $B(6, 6)$.



(a) Find the equation of the line AB.

Answer .... [2]

(b) C is a point on the x-axis such that the line BC is parallel to $x = 0$.

State the equation of line BC.

Answer .... [1]

(c) Trapezium $ACBD$ has a line of symmetry $y = 3$.

State the coordinates of D.

Answer (.............. , ...) [1]

(d) Hence, find the area of the trapezium $ACBD$.

Answer .... cm^2 [2]

13 **(a)** Express $x^2-6x+10$ in the form $(x-p)^2+q$.

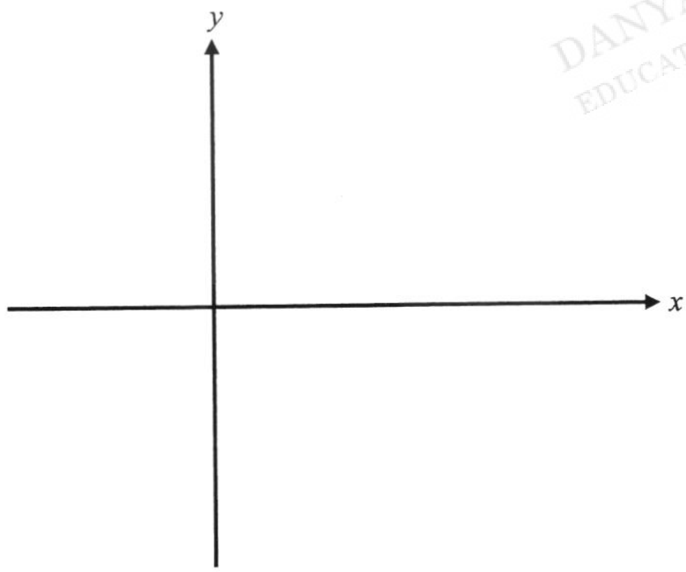
Answer .... [1]

(b) Hence,

(i) write down the minimum value of $x^2-6x+10$,

Answer .... [1]

(ii) sketch the graph of $y=x^2-6x+10$ on the axes below.
Indicate clearly the coordinates of the point where the graph crosses the axes and the minimum point on the curve.



[2]

14 **(a)** Three of the interior angles in a pentagon are 135° each. The remaining interior angles are in the ratio 3 : 2. Find the larger of the remaining interior angles.

Answer ....° [3]

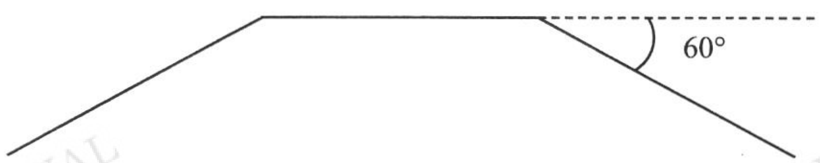
(b) Explain why it is not possible for a regular polygon to have an interior angle of 130°.

Answer ....

....

.... [2]

(c) The diagram shows part of a regular n-sided polygon.

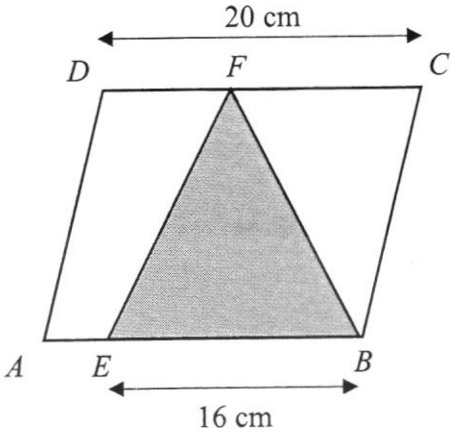


Given that the external angle of the polygon is 60°, calculate the value of n.

Answer n =................................ [1]

15 In the diagram, triangle EFB lies in a parallelogram $ABCD$.

$DC = 20$ cm, $BE = 16$ cm and the area of triangle EFB is 128 cm^2.



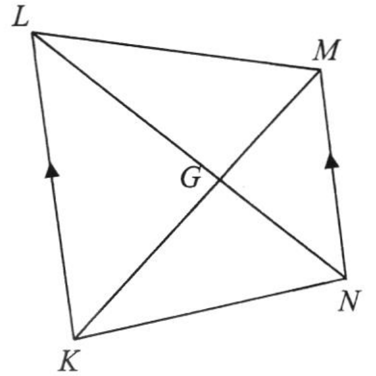
(a) Show that the height of triangle EFB is 16 cm.

Answer [1]

(b) Find the ratio of the area of unshaded region to the total area of parallelogram $ABCD$.

Answer .... : .... [2]

16 $KLMN$ is a trapezium with KL parallel to NM.
Diagonals KM and LN intersect at G such that $3LN = 5LG$.



(a) Name a pair of similar triangles and prove that they are similar.

Answer [3]

(b) Find the length of NM if $KL = 12$ cm.

Answer .... cm [2]

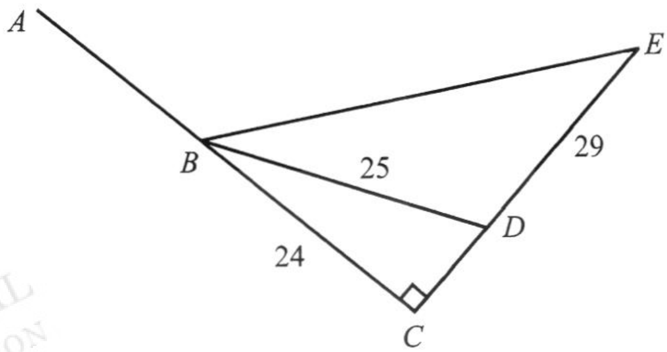
(c) Find the ratio of the area of triangle of GLK to the area of triangle NLK.

Answer .... : .... [1]

(d) Find the ratio of the area of triangle of GLK to the area of triangle GNM.

Answer .... : .... [1]

17 In the diagram, ABC and CDE are straight lines such that $\angle ACE = 90°$.
It is given that $BD = 25$ cm, $DE = 29$ cm and $BC = 24$ cm.



Find

(a) $\sin \angle BDC$,

Answer .... [1]

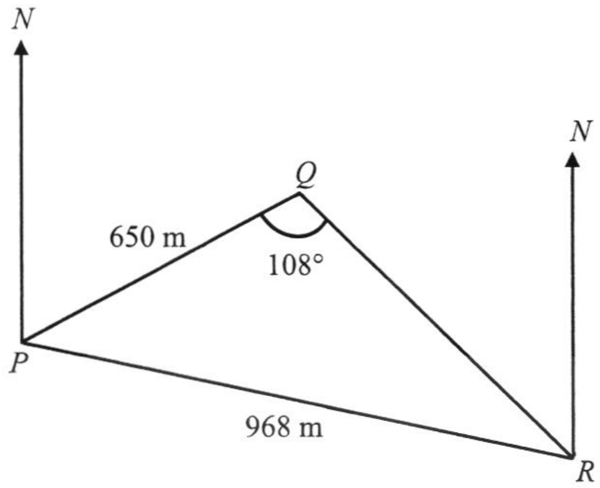
(b) $\cos \angle ABD$,

Answer .... [1]

(c) $\tan \angle BEC$.

Answer .... [2]

18



The diagram shows a field PQR.
PR is 968 m, PQ is 650 m and angle PQR is 108°.
The bearing of Q from R is 318°.

(a) Calculate the bearing of R from Q.

Answer ....° [2]

(b) Calculate the bearing of Q from P.

Answer ....° [2]

(c) Calculate angle QPR.

Answer ....° [3]

(d) John walks due east from P.
Calculate the distance he has walked when he is due north of R.

Answer .... m [2]

(e) Find the area of the field *PQR*.

Answer .... m^2 [2]

End of paper

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KRANJI SECONDARY SCHOOL

END-OF-YEAR EXAMINATION 2021

MATHEMATICS 4048
PAPER 2

Level : Secondary Three

Stream : Express

Name : ______________________________ (   )

Class : Secondary ___________

Date : 4th October 2021

Duration : 2 hr 30 mins

Total Marks Obtained : /100

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Set by: Mr Aziz

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Answer **all** the questions.

1 **(a)** Simplify $\dfrac{x^2-9}{x^2-5x+6}$.

Answer .... [3]

(b) Solve the equation $\dfrac{4}{1-10x}-\dfrac{7}{20x-2}=6$.

Answer x = ... [3]

(c) Solve these simultaneous equations.

$$5x + y = 6$$
$$3x - 5y = 26$$

Answer $x =$ ....

$y =$ .... [3]

(d) The volume, V cm^3 of an antique jar is given by the formula $V = kA^{\frac{3}{2}}$, where A cm^2 is the surface area of the jar and k is a constant.

(i) When $A = 9$, $V = 18$.
Find k.

Answer $k =$ .... [2]

(ii) Find the surface area of the antique jar if its volume is $83\frac{1}{3}$ cm^3.

Answer .... cm^2 [2]

2 Friso's milk powder are sold in two tins of geometrically similar sizes.
The weight of the tins and the selling prices are shown in the diagram below.

Small 900 g $43.20	Large 2 kg $98.50

(a) Which tin size gives a better value for consumers?
Support your justification with calculations.

Answer .... [3]

(b) The height of the small tin is 32 cm while the height of the large tin is 48 cm.

(i) Given that the base diameter of the large tin is 12 cm, calculate the base diameter of the small tin.

Answer .... cm [1]

(ii) The ratio volume of large tin : volume of small tin can be written in the form $m : n$, where m and n are both integers.

Find the value of m and the value of n.

Answer m = ...

n = ... [2]

3 In a 50 km biathlon event, competitors have to cycle 30 km from point A to point B and then run the rest of the route from point B to point C.

Johannes cycled at an average speed of x km/h from A to B.

(a) Write down, in terms of x, the time taken for him to cycle from A to B.

Answer .... h [1]

His average running speed from B to C was 6 km/h slower than his average cycling speed.

(b) Write down, in terms of x, the time taken for him to run from B to C.

Answer .... h [1]

(c) The total time taken by Johannes for the biathlon was 4 hours.

Write an equation to represent this information and show that it reduces to

$2x^2 - 37x + 90 = 0$.

Answer [3]

(d) Solve the equation $2x^2 - 37x + 90 = 0$, giving your answers correct to two decimal places.

Answer $x =$ …………. or ………… [2]

(e) Explain why one of the answers in part **(d)** is rejected.

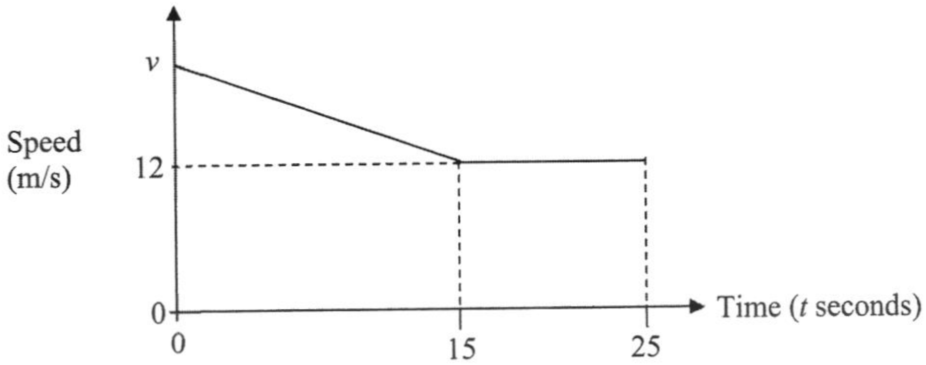
Answer …………………………………………………………………………

…………………………………………………………………………… [1]

(f) Calculate the difference in the times Johannes took to run and to cycle.
Give your answer in minutes and seconds, to the nearest second.

Answer …………. minutes …………. seconds [2]

4 The following shows the speed-time graph of a car's journey.



The car slows down uniformly from a speed of v m/s to a speed of 12 m/s in the first 15 seconds. It then travels at a constant speed for a further 10 seconds.

(a) The deceleration of the car is 0.4 m/s^2 in the first 15 seconds.
Calculate the value of v.

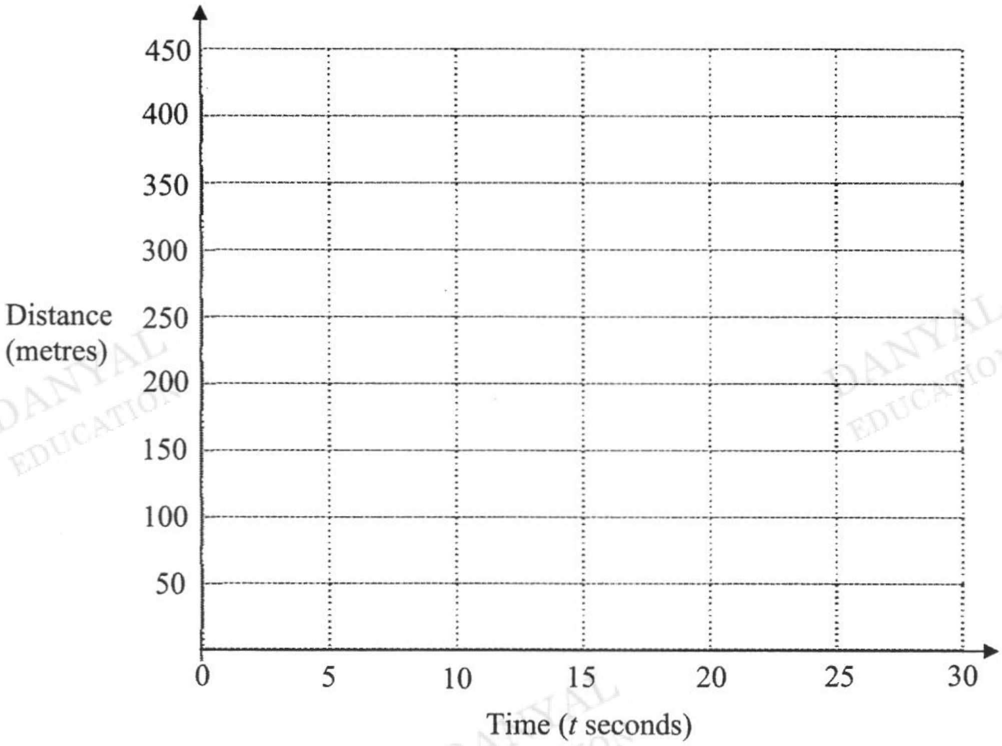
Answer v = ... [2]

(b) Calculate the total distance travelled by the car.

Answer .... m [2]

(c) On the grid below, sketch the distance-time graph for $t = 0$ to $t = 25$.

Answer [2]



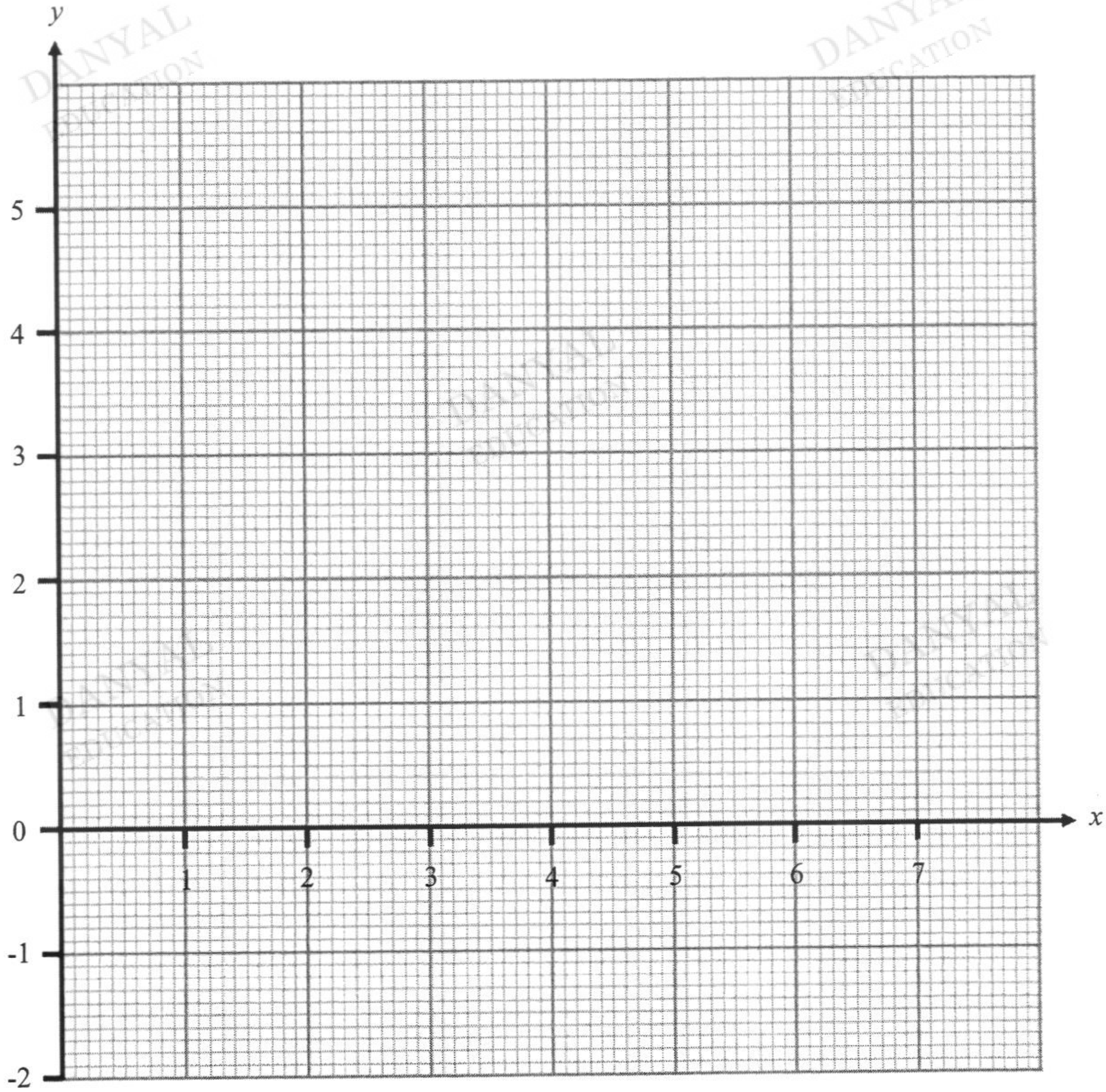
5 **(a)** Complete the table of values for $y = \frac{x^2}{6} + \frac{10}{x} - 6$.

Give your answer correct to 1 decimal place.

x	1	2	2.5	3	4	5	6	7
y	4.2	−0.3	−0.9	−1.2	−0.8	0.2	1.7	

[1]

(b) On the grid, draw the graph of $y = \frac{x^2}{6} + \frac{10}{x} - 6$ for $1 \le x \le 7$ and $-2 \le y \le 5$.



[3]

(c) The equation $\frac{x^2}{6}+\frac{10}{x}=4$ has no solution.
Explain how this can be seen from your graph.

Answer ....

.... [2]

(d) By drawing a tangent, find the gradient of the curve at $(2,-0.3)$.

Answer .... [2]

(e) **(i)** On the same axis, draw the line $y=-x+4$. [1]

(ii) Write down the x-coordinate of the points where this line intersects the curve.

Answer x = ... and .... [2]

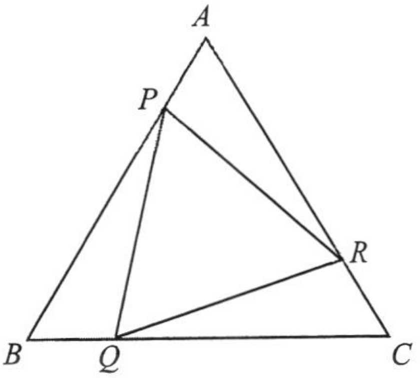
(iii) The x-coordinate of the points where this line intersects the curve are the solutions of the equation $x^3+Ax^2+Bx+60=0$.

Find the value of A and the value of B.

Answer A = ...

B = ... [2]

6



In the diagram, ABC is an equilateral triangle.
The points P, Q and R lie on AB, BC and CA respectively.
$AP = BQ = CR$.

(a) Show that triangles APR and CRQ are congruent.

Answer [3]

(b) Hence, explain why triangle PQR is an equilateral triangle.

Answer ....

.... [1]

(c) It is given that $AB = 10$ cm and $PQ = 8$ cm.
Find $\dfrac{\text{area of triangle } PQR}{\text{area of triangle } ABC}$.

Answer .... [1]

7 **(a)** In 2019, the number of people who visited Disneyland was 17.94 million.

(i) Express the number of visitors to Disneyland in standard form.

Answer .... [1]

(ii) The number of people who visited Disneyland in 2018 was 18.28 million. Calculate the percentage decrease in the number of visitors from 2018 to 2019.

Answer .... % [2]

(b) Disneyland's estimated total income increased from US$ 9 735 million in 2016 to US$ 16 160 million in 2018.

If the estimated total income increased by r% every year, find the value of r.

Answer $r =$ .... [2]

(c) Max paid for his Disneyland's entrance fee of US$119 with his credit card.

Upon his return to Singapore, he received his credit card bill.

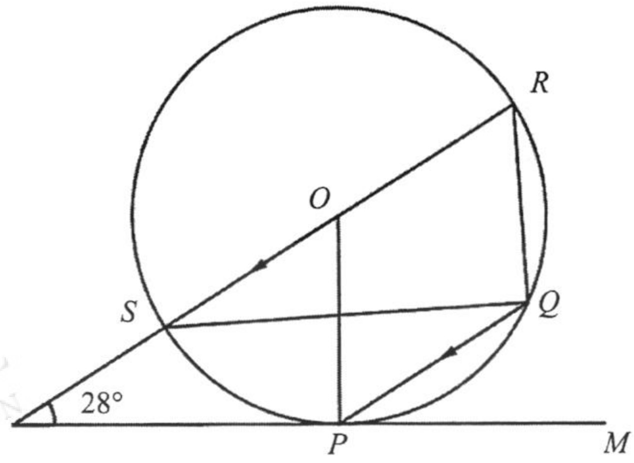
The credit card company charges a commission of 1.5%.

The exchange rate used was US$1 = $ 1.32.

Calculate the amount Max has to pay for his credit card bill.

Answer $ .... [3]

8 In the diagram, O is the centre of the circle and P, Q, R and S are points on the circumference. TPM is the tangent to the circle at the point P and meets ROS produced at T. RST is parallel to QP and angle $RTM = 28°$.



Find, giving reasons for each answer,

(a) $\angle QPM$,

Answer ....° [1]

(b) $\angle SOP$,

Answer ....° [2]

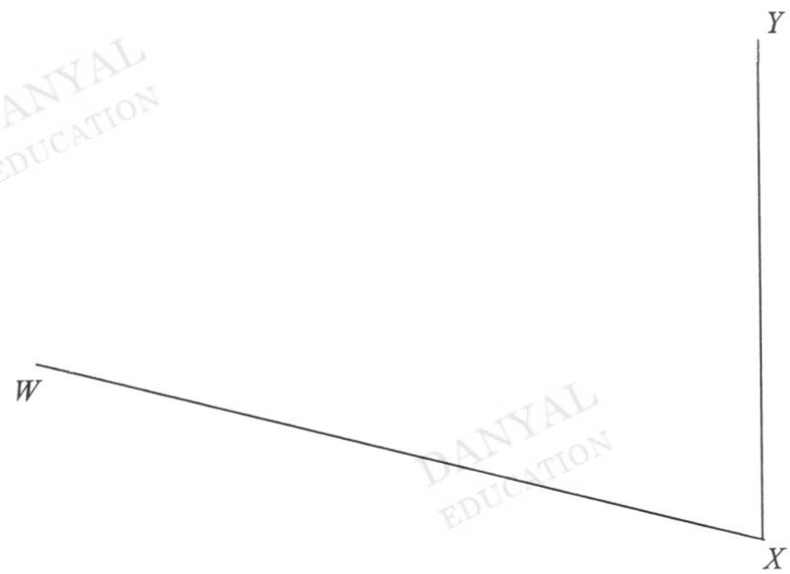
(c) $\angle SQP$,

Answer ....° [1]

(d) $\angle SRQ$.

Answer ....° [2]

9 The diagram shows the lines WX and XY.
The point Z is on the opposite side of WY to X.
WZ = 5 cm and YZ = 6.5 cm.



(a) Construct quadrilateral *WXYZ*. [2]

(b) On the diagram, construct

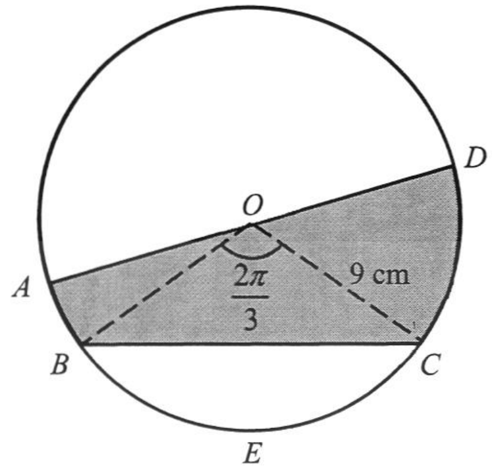
(i) the angle bisector of angle *WXY*, [1]

(ii) the perpendicular bisector of *XY*. [1]

(e) The line *PQ* consists of points, which are in the quadrilateral, equidistant from *WX* and *XY*, and nearer to *Y* than *X*.

Label the line *PQ* on the diagram. [1]

10 The diagram shows a circle, centre O, radius 9 cm.
It is given that $\angle BOC = \dfrac{2\pi}{3}$ radians.



(a) Show that $\angle BOC = 120°$

Answer [1]

(b) Find the length of the major arc BC.

Answer ……………..……….. cm [2]

(c) The shaded area in the circle is enclosed by a diameter *AD* and the chord *BC*.

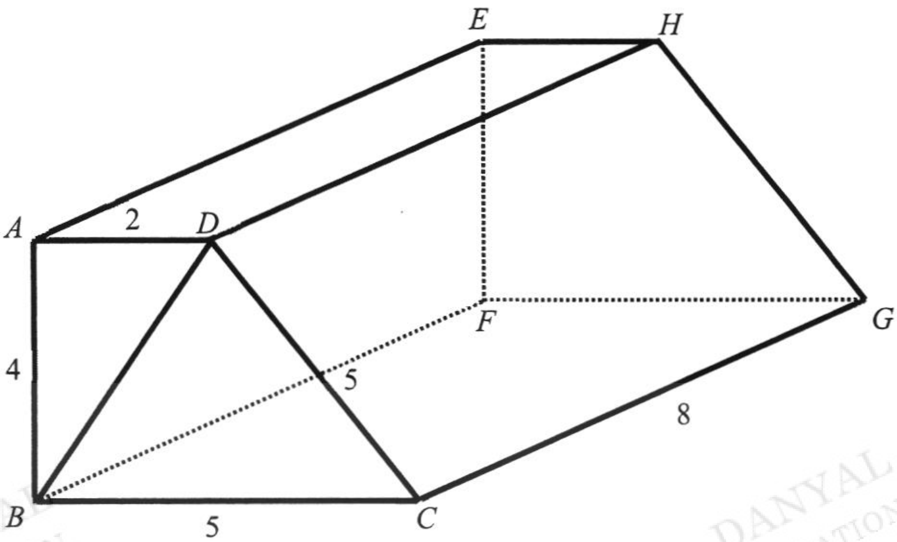
(i) Find the area of the segment *BEC*.

Answer ……………………… cm^2 [2]

(ii) Find the shaded area.

Answer ……………………… cm^2 [2]

11



The diagram shows the poles which form the frame of a tent in the shape of a trapezoidal prism.
Poles *BC, BF, CG,* and *FG* lie on the horizontal ground.
Poles *AB* and *EF* are vertical.
$AB = 4$ m, $BC = 5$ m, $CD = 5$ m, $AD = 2$ m and $CG = 8$ m.

(a) Show that $\angle BCD = 53.1°$.

Answer [2]

To reinforce the stability of the tent, a rope is tied from *C* to a point along the pole *BD*.

(b) Calculate the shortest length of rope that is used.

Answer ……………………… m [3]

(c) **(i)** Find the length of BG and DG.

Answer BG = ... m

DG = ... m [2]

(ii) Hence, find $\angle BGD$.

Answer ....° [2]

(d) Find the volume of the tent.

Answer .... m^3 [2]

12 **(a)** Diagram 1 shows a figure made up of 3 congruent circles enclosed by a circular perimeter.

The circles touch each other and the radius of each circle is 3 cm.

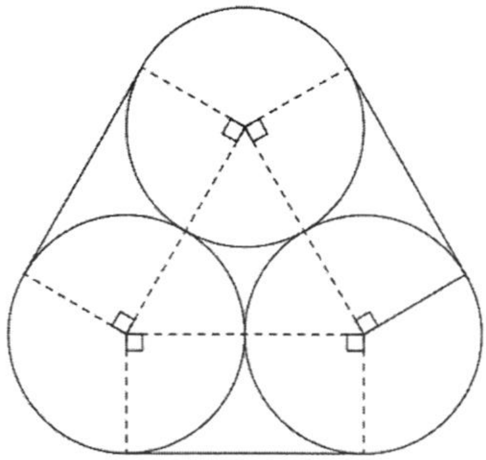


Diagram 1

(i) Show that the length of the circular perimeter is 36.85 cm, correct to 2 decimal places.

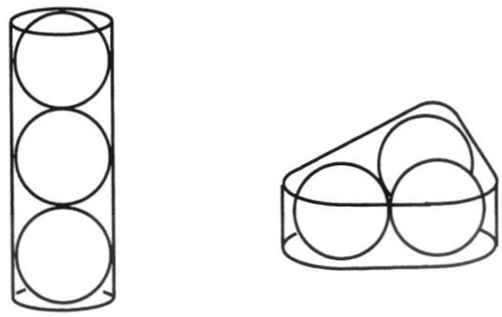
Answer [2]

(ii) Show that the area of the figure is 97.86 cm^2, correct to 2 decimal places.

Answer [3]

(b) Mr Aziz imports tennis balls and repackages them for sale. He is searching for a container design that uses the least amount of packaging material.

He narrows his search to the two designs shown below.



Design A **Design B**

Design A shows a closed cylinder.
The balls touch the ends and the sides of the cylinder.

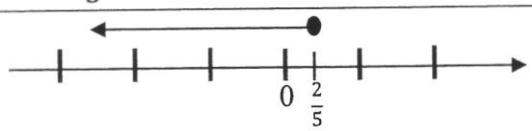
Design B is a closed triangular box where the corners are curved.
Each ball touches the top, the bottom and the sides of the box.
Each ball also touches the other two balls.
Diagram 1 is the view of Design B from above.

Which container design should Mr Aziz use in order to minimise the amount of packaging material needed?
Explain your decision with clear working.
In your investigation, model a tennis ball as a sphere of radius 3 cm.

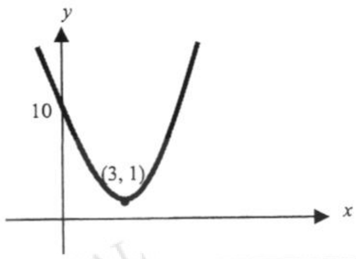
Answer [5]

End of paper

Secondary 3 EOY Paper 1 (Solutions)

1(a)	104.50626
1(b)	104.51
2(a)	Smallest number = 26650
2(b)	Largest number = 26749
3(a)	$270 = 2\times3^3\times5$
3(b)	$378 = 2\times3^3\times7$ $\text{HCF} = 2\times3^3 = 54$
3(c)	$y = 2\times3^3\times7\times k$ $k = 2\times3\times7 = 42$
4(a)	$xy - y + 1 - x = y(x-1) - 1(-1+x) = (x-1)(y-1)$
4 (b)	$2p^3 - 50p = 2p(p^2-25) = 2p(p^2-5^2) = 2p(p+5)(p-5)$
5 (a)	$\frac{3x}{2x-4y} + \frac{2}{2y-x} = \frac{3x}{2(x-2y)} - \frac{2}{x-2y} = \frac{3x-2(2)}{2(x-2y)} = \frac{3x-4}{2(x-2y)}$
5 (b)	$\frac{7x-3y}{3} = \frac{3x+4y}{4}$ $4(7x-3y) = 3(3x+4y)$ $28x-12y = 9x+12y$ $19x = 24y$ $\frac{x}{y} = \frac{24}{19} = 1\frac{5}{19}$
6 (a)	$3x-1 \le \frac{x}{2} < 1-x$ $3x-1 \le \frac{x}{2}$ and $\frac{x}{2} < 1-x$ $\frac{2}{5} \ge x$ and $x < \frac{2}{3}$ $\therefore x \le \frac{2}{5}$
6 (b)	
6 (c)	$x = 0$
7	$p = \frac{1}{1-q} - 1$ $p + 1 = \frac{1}{1-q}$ $1 - q = \frac{1}{p+1}$ $q = 1 - \frac{1}{p+1} \rightarrow q = \frac{p}{p+1}$

8 (a)	$\frac{p^2}{2q^4} \div \frac{\sqrt{p}}{(4q^3)^2} = \frac{p^2}{2q^4} \div \frac{\sqrt{p}}{16q^6} = \frac{p^2}{2q^4} \times \frac{16q^6}{\sqrt{p}} = \frac{16}{2} p^{2-\frac{1}{2}} q^{6-4} = 8p^{\frac{3}{2}}q^2$
8(b)	$\left(\frac{1}{7}\right)^k = 343 \div 49^k$ $7^{-k} = 7^3 \div 7^{2k}$ $7^{2k} = \frac{7^{\frac{3}{2}}}{7^{2k}}$ $-k = 3 - 2k$ $k = 3$
9(a)	Scale is map : actual 1 : 1000 1 cm : 1000 cm 1 cm : $\frac{1}{100}km$ 8 cm : $\left(\frac{1}{100} \times 8\right)km = \left(\frac{2}{25}\right)km$
9(b)	$1\ cm\ represent\ 0.01\ km$ $1cm^2\ represent\ 0.0001\ km^2$ $50\ cm^2\ represent\ 0.0001 \times 50 = 0.005\ km^2$
10 (a)	Balance = $\$850000 \times \frac{60}{100} = \$510000$ Interest = $\frac{(510000)(2)(15)}{100} = \$153000$
10 (b)	\$510000 + \$153000 = \$663000 15×12 = 180 months $\frac{663000}{180} = \$3683.33\ (2\ dp)$ $\therefore$ He will not exceed his budget as \$3683.33 < \$3700. (i.e. The loan repayment is lesser than his budget.)
11 (a)	$\$58.85 \times \frac{100}{107} = \$55$ $z = 58.85 - 55 = \$3.85$
11 (b)	$\$55 \times \frac{100}{110} = \$50$ $y = 55 - 50 = \$5$
11 (c)	$x = \frac{50}{4} = \$12.50$
12 (a)	$gradient = \frac{6-2}{6+3} = \frac{4}{9}$ $y = \frac{4}{9}x + c \rightarrow c = \frac{10}{3}$ $y = \frac{4}{9}x + \frac{10}{3}\ or\ 9y = 4x + 30$
12 (b)	$x = 6$

12 (c)	Coordinate = (-3,4)
12 (d)	Area of trapezium $ACBD = \frac{1}{2} \times (6+2) \times 9 = 36\ units^2$
13 (a)	$x^2 - 6x + 10 = x^2 - 6x + 3^2 - 3^2 + 10 = (x-3)^2 + 1$
13 (b)	Minimum value = 3
13 (c)	
14 (a)	Total interior angle $= 180 \times (5-2) = 540°$ Total remaining interior angle $= 540 - 135 \times 3 = 135°$ Larger of remaining interior angle = $\frac{135}{3+2} \times 3 = 81°$
14 (b)	$\frac{180 \times (n-2)}{n} = 130$ $n = 7.2$ n represents the number of sides, thus it should be a whole number. Since in this case, n is not a whole number, thus $130°$ cannot be an interior angle of any regular polygon.
14 (c)	Number of sides $(n) = \frac{360}{60} = 6$
15 (a)	$128 = \frac{1}{2} \times 16 \times H \rightarrow H = 16\ cm$
15 (b)	$20 \times 16 = 320$ cm^2 $320 - 128 = 192$ cm^2 Ratio = 192 : 320 = 3 : 5
16 (a)	Triangle *GLK* is similar to Triangle *GNM*. $\angle LGK = \angle NGM\ (vert.opp.\angle s)$ [A] $\angle GLK = \angle GNM\ (alt.\angle s, LK//NM)$ [A] $\angle GKL = \angle GMN\ (alt.\angle s, LK//NM)$ [A] $\therefore$ Triangle *GLK* is similar to triangle *GNM*. (2 pairs of corresponding angles are equal)
16 (b)	$LN : LG = 5 : 3$ Scale factor = 1.5 $NM = \frac{12}{1.5} = 8\ cm$
16 (c)	Area of triangle *GLK* : Area of triangle *NLK* = 3 : 5
16 (d)	Area of triangle *GLK* : Area of triangle *GNM* = 9 : 4

17 (a)	$\sin \angle BDC = \frac{24}{25}$
17 (b)	$\cos \angle ABD = -\cos \angle DBC = -\frac{24}{25}$
17 (c)	$CD^2 = 25^2 - 24^2 = 49 \rightarrow CD = 7\ cm$ $\text{Tan}\ \angle BEC = \frac{24}{29+7} = \frac{2}{3}$
18 (a)	$360° - 318° = 42°$ Hence $Bearing\ of\ R\ from\ Q = 180° - 42° = 138°$
18 (b)	$360° - 108° - 138° = 114°\ ;\ 180° - 114° = 66°$ $Bearing\ of\ Q\ from\ P = 066°$
18 (c)	$\frac{\sin 108°}{968} = \frac{\sin\angle QRP}{650}$ $\angle QRP = 39.68919°$ $\angle QPR = 180° - 108° - 39.68919° = 32.3108°\ (6\ sf) = 32.3°\ (1\ dp)$
18 (d)	$42° + 39.7° = 81.68919°$ $Sin\ 81.68919° = \frac{d}{968}$ $d = 957.835 = 958\ m\ (3\ sf)$
18 (e)	Area of field $PQR =$ $\frac{1}{2}(650)(968)\sin(32.3108)$ $= 168157m^2\ (6\ \text{sf})$ $= 168000m^2\ (3\ \text{sf})$

Secondary 3 EOY Paper 2 (Solutions)

1(a)

$$\frac{x^2-9}{x^2-5x+6}=\frac{(x-3)(x+3)}{x^2-5x+6}=\frac{(x-3)(x+3)}{(x-3)(x-2)}=\frac{x+3}{x-2}$$

1(b)

$$\frac{4}{1-10x}-\frac{7}{20x-2}=6$$
$$\frac{4}{1-10x}+\frac{7}{2(1-10x)}=6$$
$$\frac{8+7}{2(1-10x)}=6$$
$$15=12(1-10x)$$
$$120x=-3$$
$$x=-\frac{1}{40}=-0.025$$

1(c)

$5x+y=6$ ------ (1)

$3x-5y=26$ ------- (2)

(1)×5: $25x+5y=30$ ------ (3)

(3) + (2): $28x=56$

$x=2$

Sub into (1): $y=-4$

1 (d) (i)

Sub $A=9$ and $V=18$ into $V=kA^{\frac{3}{2}}$, $18=k(9)^{\frac{3}{2}}$

$$k=\frac{2}{3}$$

1 (d)(ii)

$Sub\ V=83\frac{1}{3}$, $83\frac{1}{3}=\frac{2}{3}(A)^{\frac{3}{2}}$

$\frac{250}{3}\times\frac{3}{2}=(A)^{\frac{3}{2}}$

$(A)^{\frac{3}{2}}=125$

$A=25\text{ cm}^2$

2 (a)

For Small Tin:	**For Large Tin**:
$900g-\$43.20$	$2kg-\$98.50$
$100g-\$4.80$	$1kg-\$49.25$
$1kg-\$48.00$	

The cost per kg for small tin, \$48, is less than that for large tin, \$49.25. Hence, the small tin gives a better value for consumers.

2 (b)(i)

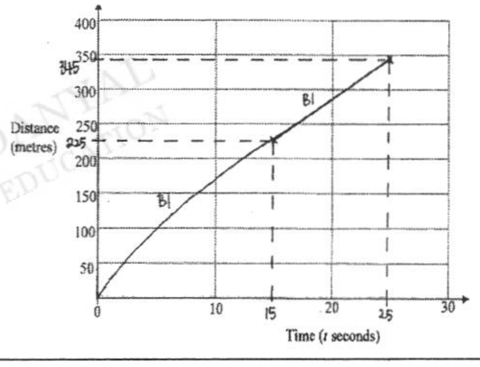
$\frac{32}{48}=\frac{d}{12}$

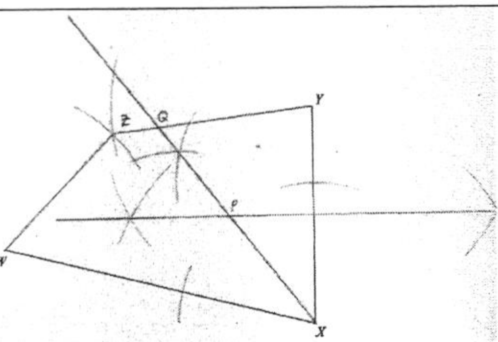
$d=\frac{32}{48}\times 12=8\ cm$

2(b) (ii)

$\left(\frac{32}{48}\right)^3=\frac{32768}{110592}=\frac{8}{27}$

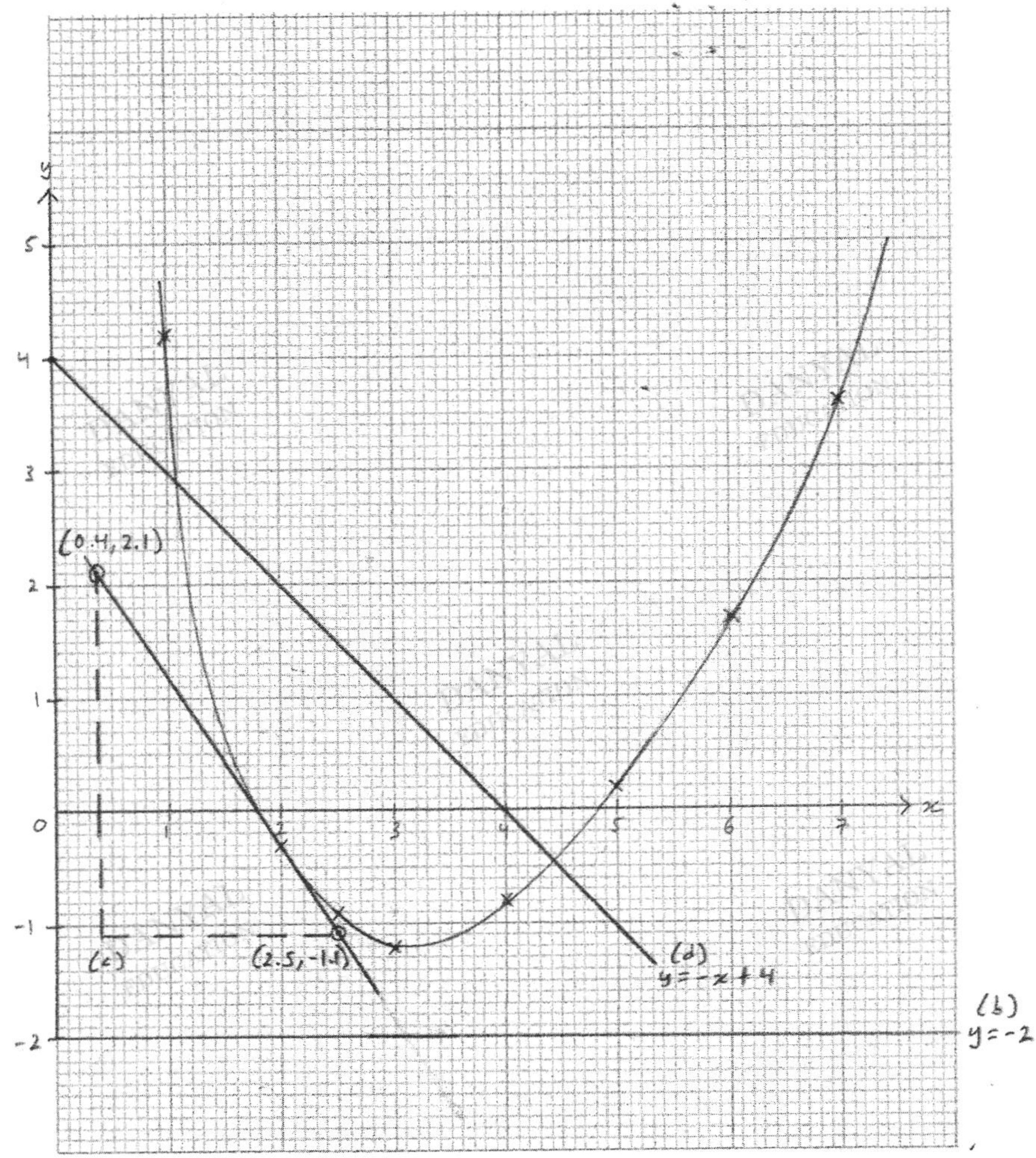
$m:n=27:8 \rightarrow m=27, n=8$

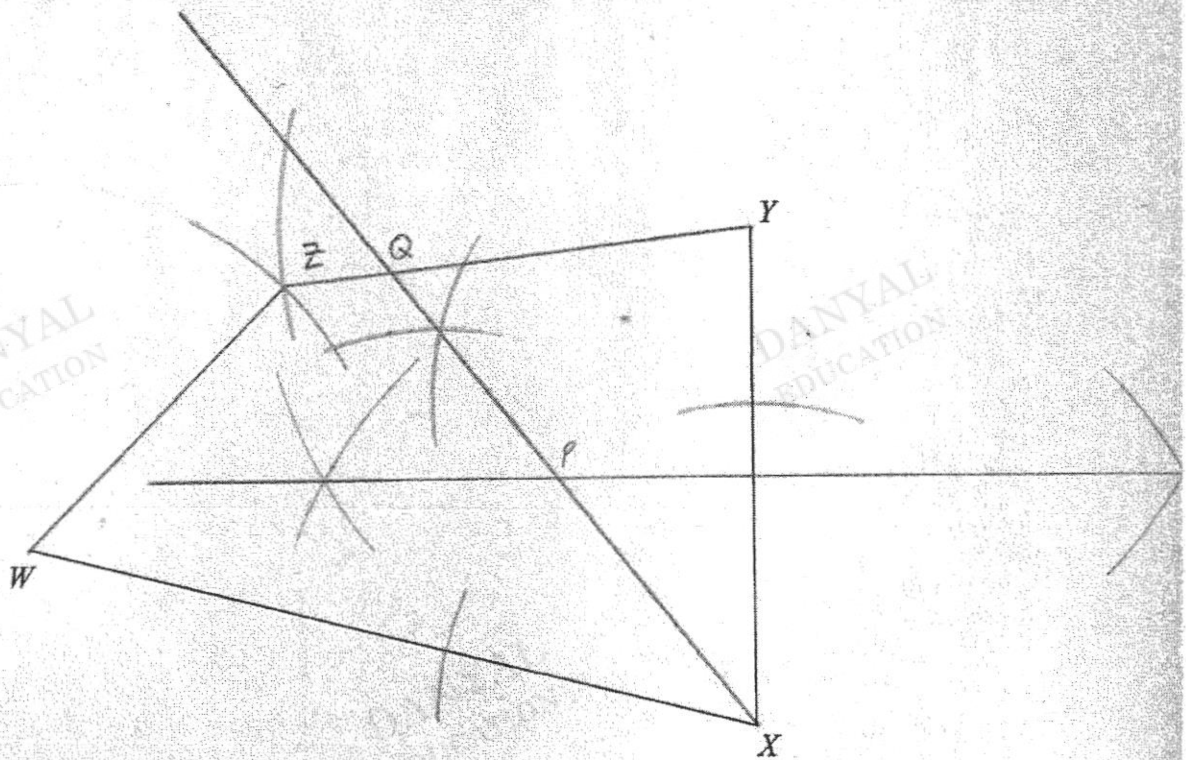
3 (a)	Time taken = $\left(\frac{30}{x}\right) h$
3 (b)	Time taken = $\left(\frac{20}{x-6}\right) h$
3 (c)	$\frac{30}{x}+\frac{20}{x-6}=4$ $30(x-6)+20x=4(x)(x-6)$ $30x-180+20x=4x^2-24x$ $4x^2-24x-30x+180-20x=0$ $4x^2-74x+180=0$ $2x^2-37x+90=0$
3 (d)	$x=\frac{-(-37)\pm\sqrt{(-37)^2-4(2)(90)}}{2(2)}$ $x=\frac{37+\sqrt{649}}{4}\ or\ \frac{37-\sqrt{649}}{4}$ $x=15.62\ or\ 2.88$
3 (e)	When substituting x = 2.88 into $\left(\frac{20}{x-6}\right)$, the time taken would be $-6.41\ h$, which is impossible since **time taken cannot be negative**. Hence x = **2.88 is rejected.**
3 (f)	Time taken to cycle = $\left(\frac{30}{15.6189}\right) h = 1.9207\ h$ Time taken to run = $\left(\frac{20}{15.6189-6}\right) h = 2.0792\ h$ Difference = 2.0792 - 1.9207 = 0.1585 h = 9 min 31 secs (nearest second)
4 (a)	$\frac{12-v}{15}=-0.4$ $v=18$
4 (b)	Total Distance = $\frac{1}{2}(18+12)(15)+(10)(12)$= 345 m
4 (c)	
5(a)	When $x = 7$, $y = 3.6$
5(b)	Refer to Annex A
5(c)	$\frac{x^2}{6}+\frac{10}{x}-6=4-6$ State line $y=-2$. Line does not cut the curve, hence there is no solution.
5(d)	Tangent correctly drawn at (2 , –0.3) Gradient = –1.83 (accept –1.2 to –2.1)
5 (e)(i)	Refer to Annex A
5 (e)(ii)	$x=1.1$ and 4.45 (accept ±0.05 for both values of x)

5(e)(iii)	$\frac{x^2}{6}+\frac{10}{x}-6=-x+4$ $x^3+60-36x=-6x^2+24x$ $x^3+6x^2-60x+60=0$ $A=6$, $B=-60$
6 (a)	Since ABC is an equilateral triangle, $AC-RC=AR$ & $BC-BQ=QC$ $\therefore AR=CQ$ $RC=BQ$ (given) $\angle PAR=\angle RCQ$ (equilateral triangle) $\angle APR=\angle CRQ$ (SAS) $\therefore$ APR *is congruent to* CRQ.
6 (b)	Since, APR *is congruent to* CRQ *and* BPQ, $PR=RQ=QP$, PQR is an equilateral triangle.
6 (c)	$\frac{Area\ of\ triangle\ PQR}{Area\ of\ triangle\ ABC}=\left(\frac{8}{10}\right)^2=\frac{16}{25}$
7 (a)(i)	Total number of visitors = 1.794×10^7
7(a)(ii)	Percentage decrease = $\frac{18.28-17.94}{18.28}\times 100 = 1.86\%$
7(b)	$16160=9735\left(1+\frac{r}{100}\right)^2$ $r=28.8\%$
7(c)	$119\times 1.32\times\frac{101.5}{100}=\$159.44$
8 (a)	$\angle QPM=28°$ $(Corr.\angle s, RT\ //\ QP)$
8 (b)	$\angle OPT=90°$ $(Tangent\ \perp\ Radius)$ $\angle SOP=180°-28°-90°=62°$ $(Total\ \angle s\ in\ a\ triangle)$
8 (c)	$\angle SQP=\frac{62°}{2}=31°$ $(\angle\ at\ centre=2\ \times\angle\ at\ circumference)$
8 (d)	$\angle OSQ=31°$ $(Alt.\angle, RS//\ QP)$ $\angle SRQ=180°-31°-90°=59°$ $(rt.\angle\ in\ semicircle)(Total\ \angle s\ in\ a\ triangle)$
9	

10 (a)	$Angle\ in\ degrees = \frac{2\pi}{3} \times \frac{180}{\pi} = 120° \ (Shown)$
10 (b)	Major arc BC $= 9(2\pi - \frac{2\pi}{3})$ $= 37.69911 = 37.7$ cm
10 (c)(i)	Segment $BEC = \frac{1}{2}(9)^2\left(\frac{2\pi}{3}\right) - \frac{1}{2}(9)(9)sin\frac{2\pi}{3} = 49.74897$ cm^2 $= 49.7$ cm^2 (3 sf)
10(c)(ii)	Shaded area $= \frac{1}{2}\pi(9)^2 - 49.74897 = 77.4855$ cm^2 $= 77.5$ cm^2 (3 sf)
11(a)	$\sin\angle BCD = \frac{4}{5}$ $\angle BCD = \sin^{-1}\left(\frac{4}{5}\right) = 53.130°(3\ d.p) = 53.1°(1\ d.p)$
11(b)	$BD = \sqrt{\ ^2 + \ ^2} = \sqrt{20} = \qquad m \quad s\,f$ Let X be the midpoint of BD $BX = \frac{4.4721}{2} = 2.2361\ cm$ Let the shortest length be d, $5^2 - 2.2361^2 = d^2$ $d = 4.4721 = 4.47$ m (3 sf)
11(c)(i)	$BG = \sqrt{8^2 + 5^2} = \sqrt{89} = 9.433981\ cm$; $DG = \sqrt{8^2 + 5^2} = \sqrt{89} = 9.433981\ cm$
11(c)(ii)	Using Cosine Rule, $(\sqrt{20})^2 = (\sqrt{89})^2 + (\sqrt{89})^2 - 2(\sqrt{89})^2 cos\angle BGD$ $\angle BGD = 27.4°$ (1 d.p)
11(d)	Area of Trapezium $ABCD = \frac{1}{2}(2+5)(4) = 14m^2$ Volume of Tent $= 14 \times 8 = 112m^2$
12 (a)(i)	Arc of circle in contact with ball $= \frac{120}{360} \times 2\pi(3) = 2\pi$ Perimeter $= 3(2\pi) + 3(6) = 36.849555 = 36.85$ cm (shown)
12(a)(ii)	Area = 3 sectors + 3 rectangles + 1 equilateral triangle Sector $= \frac{120}{360} \times \pi(3)^2 = 3\pi$ cm^2 Rectangle $= 6 \times 3 = 18$ cm^2 Triangle $= \frac{1}{2}(6)(6)\sin 60° = 15.5884$ cm^2 Area $= 97.86279 = 97.86$ cm^2 (shown)
12 (b)	Total Surface Area of Design A $= 2 \times \pi(3)^2 + 2\pi(3) \times 18 = 395.8406$ cm^2 Total Surface Area of Design B $= 36.849555 \times 6 + 2 \times 97.86279 = 416.8229$ cm^2 Total surface area of Design A, 395.8406cm^2, is less than that of Design B, 416.8229cm^2. Hence the amount of packaging material needed for Design A is less than that of Design B. Thus Mr Aziz should use Design A.

Answer

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