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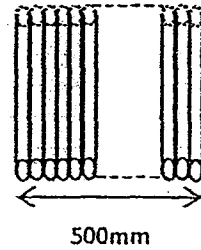


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- 1 The diameter of a man-made fibre strand is measured to be 8 nanometres. They are made into sheets of width 500 millimeters. If the sheets are made in a way that the fibre strands are placed side by side without overlapping, find the number of fibre strands in each sheet, expressing the answer in standard form.



Answer [2]

- 2 Given that the ratio of $a : b$ is $5 : 2$ and that $x = \frac{\sqrt{a+4}}{3}$ and $b = 2(3x^2 - 4x - 4)$, find the value of x .

Answer [3]

- 3 Simplify $\frac{a^2 \times \sqrt[3]{b^{-2}}}{4a} \div \frac{a^{-3}}{8 \times \sqrt[3]{\frac{1}{b}}}$ and express your answer in index notation.

Answer [2]

- 4 A sum of \$23 000 is invested for 3 years at 4% per annum compound interest. Find the total interest earned if it is compounded half yearly. Leave your answer to the nearest cent.

Answer \$..... [3]

- 5 One of the exterior angles of a polygon is 18° and the rest of the exterior angles are similar. Find the number of sides of the polygon if one of the interior angles is 123° .

Answer [2]

- 6 The amount of money carried by a group of students on a particular day are represented in the stem-and-leaf diagram below.

7	2	3						
8	1	3	4	4				
9	3	3	6	6	6	8	8	
10	0	1	7	9				

Key 7 | 2 means 72 dollars

Write down

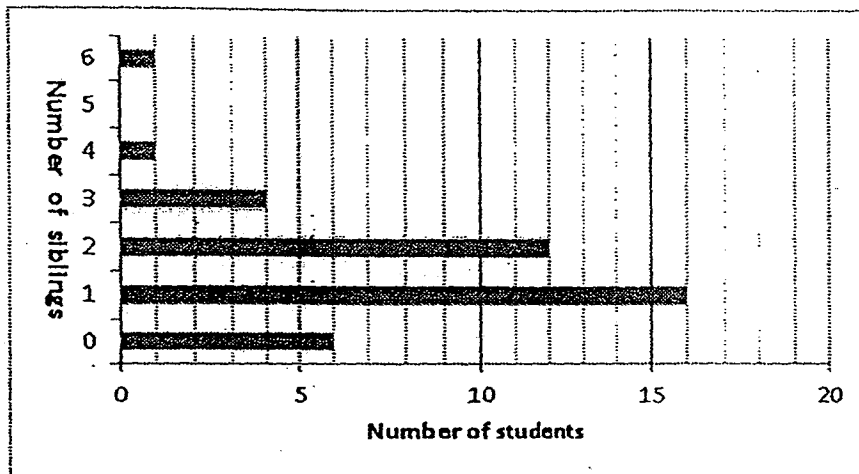
- (a) the mode,
- (b) the median,
- (c) the interquartile range.

Answer (a) \$..... [1]

(b) \$..... [1]

(c) \$..... [1]

- 7 The following bar chart illustrates the number of siblings that students have in a class. For example, there are 16 students who have one sibling.



- (a) Find the percentage of students who have two or three siblings.
 (b) Comment briefly on the number of siblings in a family.
 (c) Represent the information using a pie chart.

Answer (a)% [1]

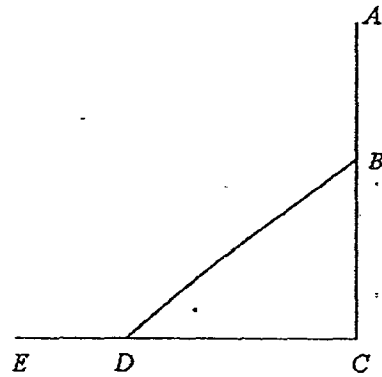
(b)

.....

..... [1]

(c) As shown above [2]

- 8 In the diagram, line AC is perpendicular to line CE , while BD is twice the length of CD . Find angle BDE in degree.



Answer° [2]

- 9 Solve the equation $\frac{2(x-4)}{5x^2-3x-8} = \frac{1}{x+1} + \frac{1}{3}$.

Answer [3]

- 10 A box contains 2 mint-flavoured sweets, 3 chocolate-flavoured sweets and 7 strawberry-flavoured sweets. Three sweets are taken out at random, without replacement. Find the probability that at least 1 chocolate flavoured sweets are taken.

Answer [2]

- 11 A quadratic equation $ax^2 + bx + c = 0$, where a , b and c are constants, has roots $-5 \pm \frac{1}{\sqrt{2}}$. Find the values of a , b and c .

Answer [2]

- 12 Given that $\vec{PQ} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$, $\vec{QR} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$, $\vec{OR} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ and $\vec{OS} = \begin{pmatrix} 4 \\ x \end{pmatrix}$, where O is the origin.

- (a) Find $|\vec{PR}|$. Giving your answer correct to two decimal places.
- (b) If $\vec{QR}$ is parallel to $\vec{RS}$, find the value of x .

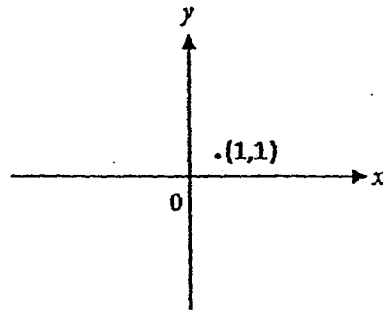
Answer (a) [2]

(b) [3]

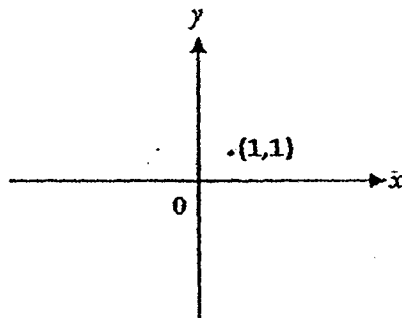
- 13 On the axes shown below, sketch the following graphs.

[3]

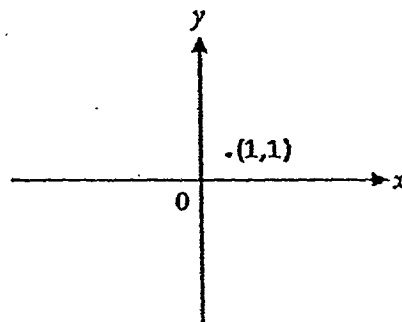
(a) $y = -\frac{1}{x^2}$



(b) $y = \frac{1}{2x}$



(c) $y = -2x^3$



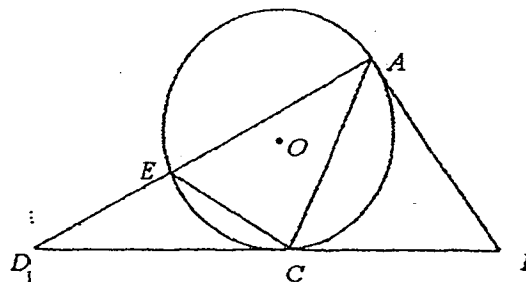
- 14 Find the HCF and LCM of $(2x)^2$ and $5x^3y$.

Answer HCF = ... [1]

LCM = ... [1]

- 15 In the diagram below, given that triangle ABC is an equilateral triangle,
 $\angle AEC = \angle ACB$, $\angle DCE = 32^\circ$ and line DB is tangent to the circle at C , find

- (a) $\angle CAE$,
 (b) $\angle AOC$,
 (c) $\angle OAE$.



Answer (a) $^\circ$ [1]

(b) $^\circ$ [1]

(c) $^\circ$ [1]

- 16 These are the first four terms in a sequence,
 4, 7, 10, 13, ...

- (a) Write down an expression, in terms of n , for the n th term in the sequence.
 (b) Write down the term that has the value of 1504.

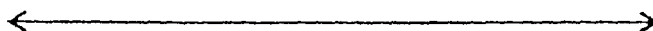
Answer (a) [1]

(b) [2]

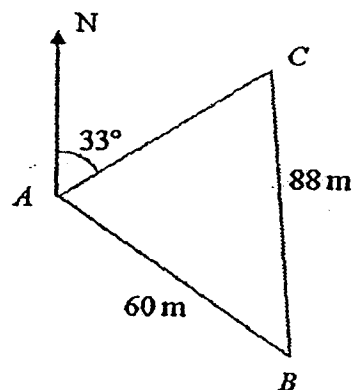
- 17 Solve $\frac{1}{2}x - 3x < -2 - 2(x - 2) \leq -3(x - 1)$. Represent your solutions on a number line.

Answer

[3]



- 18 The diagram shows 3 points A , B and C on the level ground, where BC is 88 m and AB is 60 m and the bearing of B from A is 136° , calculate the bearing of B from C .



Answer $^\circ$ [3]

- 19 Ms. Sim gave sweets to three students in the ratio of 2 : 3 : 6 respectively. She later changed her mind and gave 5 more sweets to the second student. The new ratio of the sweets given to the students is 3 : 7 : 9 respectively, find
- the total number of sweets Ms. Sim first gave to the students,
 - the sum of sweets received by the first and third students.

Answer (a)..... [3]

(b)..... [1]

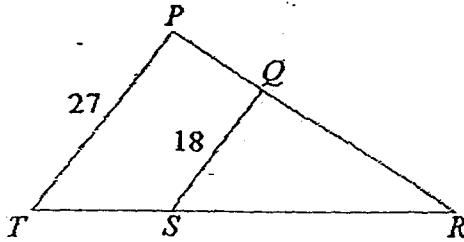
- 20 A map has a scale of 1 : 30 000. The length of a rectangular park is 7 cm on the map.

- Find the actual length of the park in km.
- Given that the park covers an area of 7 km^2 . Find the breadth of the park in cm on the map.

Answer (a).....km [1]

(b).....cm [2]

- 21 (a) In the figure below, given that PT is parallel to QS , find the ratio of $PQ:QR$.



Answer [2]

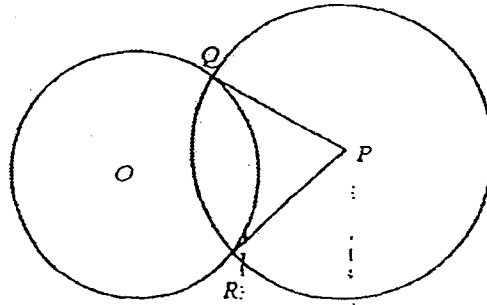
- (b) The interior of 2 identical ice-cream cones are coated with a thin layer of chocolate. (The thickness of the chocolate layer is negligible)
The cheaper one is coated with chocolate up to one-third of its perpendicular height and the more expensive one is entirely coated with chocolate.
- Find the ratio of the surface areas of chocolate coated in the cheaper cone to the expensive cone.
 - Chocolate cream is poured into the cheaper cone up to one-third of its perpendicular height and then vanilla cream is poured to fill up to the brim of the cone. Find the ratio of the volume of the chocolate cream to the volume of the vanilla cream.

Answer (b)(i) [1]

(b)(ii) [2]

22

The diagram below consists of two circles with centres O and P , with radii of 5 cm and 7 cm respectively. Given that line QR is 8 cm, find,



- (a) acute $\angle QPR$ in radian,
 (b) the perimeter of the minor sector OQR .

Answer (a) radian [2]

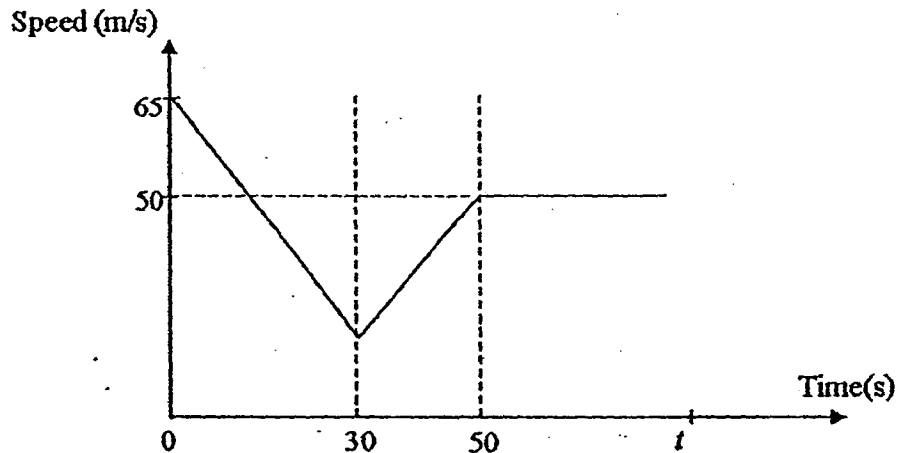
(b) cm [2]

- 23 A line AB passes through the point $(3,10)$ is parallel to another line of equation $x = \frac{1}{3}(y+5)$. Find the x and y -intercepts of the line AB .

Answer x -intercept = ...

y -intercept = ... [2]

- 24 A prototype sports car was travelling at 65 m/s when it went off the road and onto grass patch for 30 seconds before it got back on the road. Below is the diagram that shows the speed-time graph of the car.



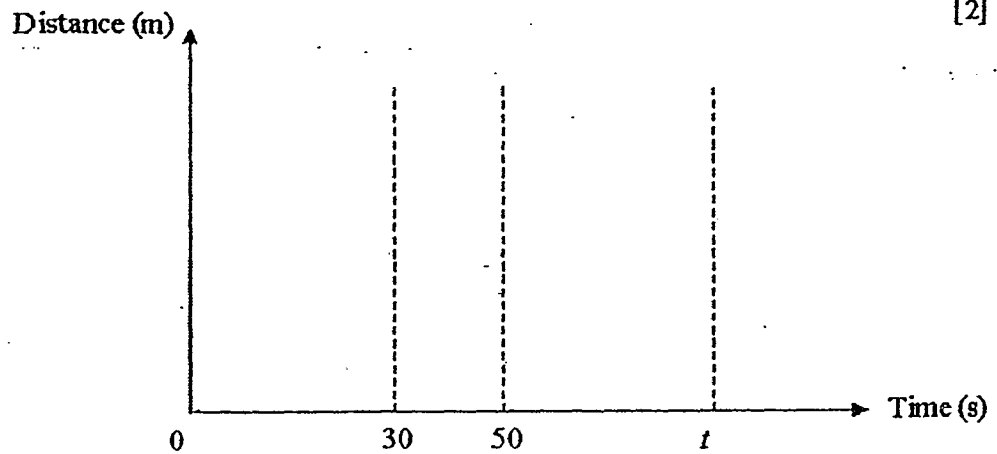
- (a) If the car undergoes a deceleration of 1.2 m/s^2 when it is on the grass patch, find the distance it travelled for the first 30 seconds on the grass patch.

Answer (a) m. [1]

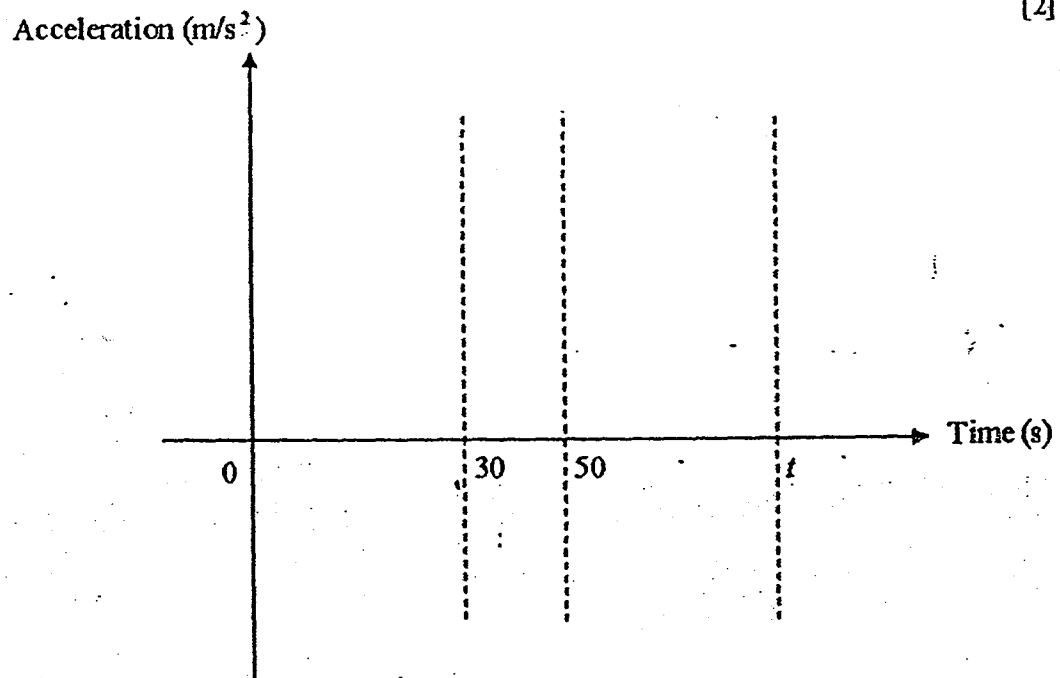
- (b) If the total distance travelled by the car for the whole journey is 3800 m, find the value of t .

Answer (b)..... [1]

- (c) Sketch the distance-time graph of the car during the period of t seconds. [2]



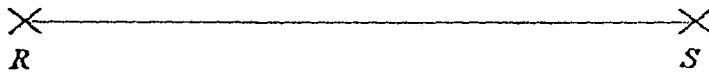
- (d) Sketch the acceleration-time graph of the car during the period of t seconds. [2]



25

Three landmarks, a restaurant, stadium and temple are represented by points R , S and T . The restaurant is 900m away from stadium and 750 m from the temple, while the stadium and temple are 550 m apart.

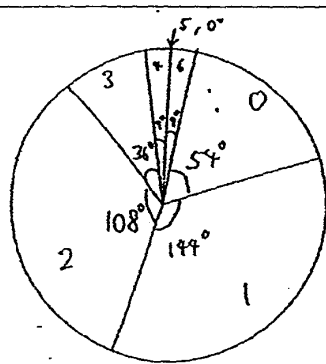
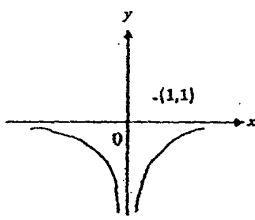
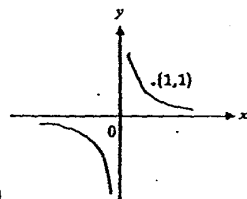
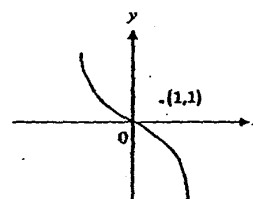
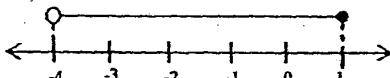
Answer (a), (b), (c)

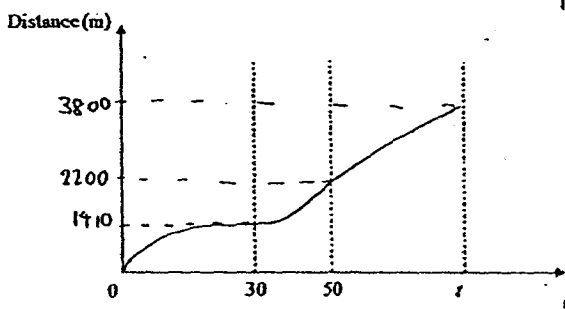
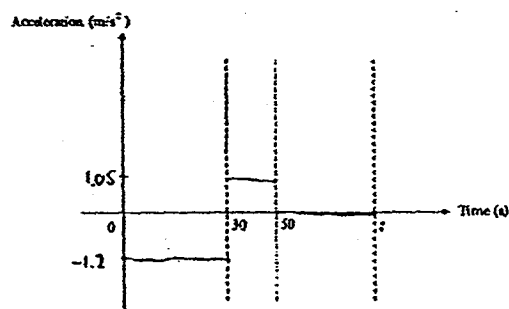
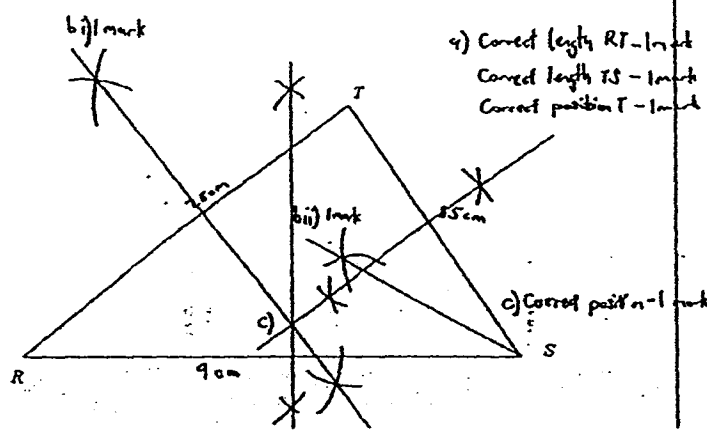


- (a) Using a scale of 1 cm to represent 100 m, make an accurate scale drawing of the positions of the landmarks. Line RS has been drawn for you. [
- (b) On your diagram, construct and label clearly, [
- (i) the possible positions of a boy if he is standing equidistant to both the restaurant and the temple, [
- (ii) the bisector of angle RST . [
- (c) Mark clearly the position that the boy should stand such that he is equidistant from all three landmarks. [

END OF PAPER 1

Answer Key

1. 6.25×10^7	2. $x=4$							
3. $\frac{2a^4}{b}$	4. $I = \$2901.74$							
5. $n = 7$	6. (a) \$96 (b) \$96 (c) \$15.50							
7. (a) 40% (b) Majority of family consists of 1 or 2 siblings, 70% of students have 1 or 2 siblings	7(c) 							
8. $\angle BDE = 120^\circ$	9. $x = \frac{4}{5}$ or $x = -\frac{34}{55}$							
11. $2x^2 + 20x + 49 = 0$ or $x^2 + 10x + \frac{49}{2} = 0$	12(a) $\left \vec{PR} \right = \sqrt{7^2 + (-7)^2} = 9.90$ (2dp) (b) $x=0.5$							
13 (a) 	(b) 	(c) 						
14. $\text{HCF} = x^2y$ $\text{LCM} = 20x^3y^2$	15. <table border="1"> <tr> <td>15(a)</td> <td>$\angle CAE = 180^\circ - 60^\circ - 88^\circ = 32^\circ$</td> </tr> <tr> <td>15(b)</td> <td>$\angle AOC = 120^\circ$</td> </tr> <tr> <td>15(c)</td> <td>$\angle OAE = 2^\circ$</td> </tr> </table>	15(a)	$\angle CAE = 180^\circ - 60^\circ - 88^\circ = 32^\circ$	15(b)	$\angle AOC = 120^\circ$	15(c)	$\angle OAE = 2^\circ$	16(a) $T_n = 4 + 3(n-1)$ 16(b) $3n+1 = 1504$ 16. $n = 501$
15(a)	$\angle CAE = 180^\circ - 60^\circ - 88^\circ = 32^\circ$							
15(b)	$\angle AOC = 120^\circ$							
15(c)	$\angle OAE = 2^\circ$							
17. 								

18. Bearing of B from C = 171.4°	19 (a) the total sweets given is 33 (b) 2 students have 24 sweets in total.
20. (a) 7cm : 2.1 km (b) breadth = $11\frac{1}{9}$ cm	21 (a) (i) ration = 1:2 (b) (i) ratio : 1:9 (ii) Ratio = 1:26
22 (a) $\angle QPR = 1.22$ rad (b) Perimeter = 19.25 cm	23. x-intercept = $-\frac{1}{3}$ cm y-intercept = 1
24. (a) Distance travelled 30 seconds into journey = 1410m (b) t=82	
(c) 	(d) 
25. 	

Answer all the questions

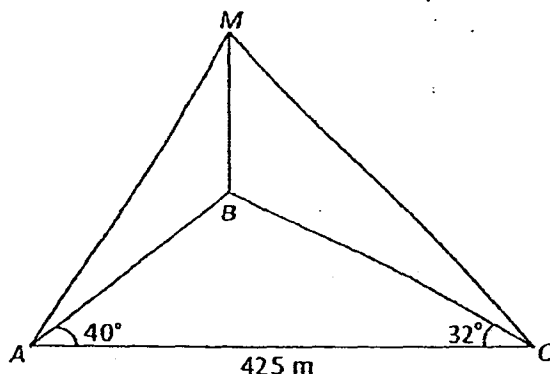
1. (a) Simplify $\frac{3}{1+x} + \frac{5x}{x^2-1}$. [2]

(b) Solve the equation $\frac{4}{4x^2+x-14} = 1 - \frac{2}{x+2}$ giving your answers correct to 2 decimal places. [5]

(c) Factorise completely $9x^4 - 4x^2 - 9x^2y^2 + 4y^2$. [3]

(d) Make y the subject of the formula $\frac{2}{3x} = \frac{1}{2} + \frac{4}{y}$. [3]

2.



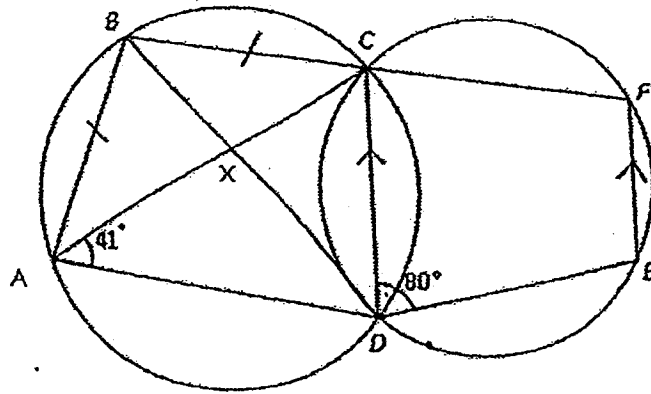
A , B and C are points on level ground. $AC = 425$ m, $\angle BAC = 40^\circ$ and $\angle BCA = 32^\circ$. A man at M is looking down from the top of a vertical building situated at B . The angle of depression of A from M is 57° .

- (a) (i) Find the distance of AB . [2]
 (ii) Find the height of the building. [2]

(b) The man at M observes a boy walks from A to C .

- (i) Find the shortest distance between the boy and the building during his walk. [2]
 (ii) Find the maximum angle of elevation from the boy to the top of the building at M during his walk. [2]
 (iii) Find the distance of the boy from A when he is equidistant from A and B during his walk. [3]

3.



The diagram shows two circles intersecting at C and D . BCF is a straight line with DC parallel to EF and AC intersects BD at X .

Given that $AB = BC$, $\angle CAD = 41^\circ$ and $\angle CDE = 80^\circ$, calculate

- (a) $\angle BCD$, [1]
- (b) $\angle BAC$, [2]
- (c) $\angle CXD$. [3]

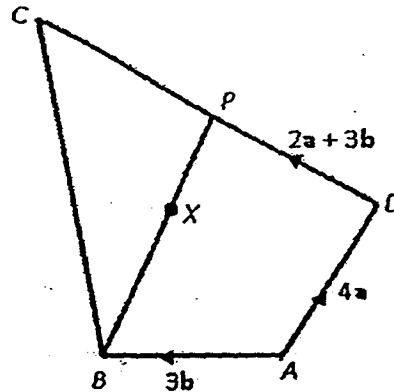
4. In the diagram, P is a point on DC such that $DC = 2DP$ and X is a point on BP such that $3BX = 2BP$. $\overline{AD} = 4a$, $\overline{AB} = 3b$ and $\overline{DP} = 2a + 3b$.

(a) Express, as simply as possible, in terms of a and/or b ,

(i) $\overline{BP}$, [1]

(ii) $\overline{AX}$, [1]

(iii) $\overline{AC}$. [1]



- (b) From your answers to (a)(ii) and (a)(iii), what can you deduce about the points A , X and C ? [1]

- (c) Given that the area of $\triangle BCP = 24 \text{ cm}^2$, find the area of $\triangle CXP$. [2]

- (d) Find $\frac{\text{area} \triangle ABX}{\text{area} \triangle CBP}$. [2]

5. A durian hawker bought 30 crates of durians at \$ x per crate. There were 15 durians in each crate.

(a) Write down the cost price of each durian in terms of x . [1]

(b) Some of the durians were rotten and discarded. The cost of all the discarded durians was \$110. Show that the number of discarded durians was $\frac{1650}{x}$. [1]

The durian hawker sold all the remaining durians at \$5 each and made, on the whole, a profit of \$1010.

(c) Show that the total selling price of all the durians was $\$ \left(2250 - \frac{8250}{x} \right)$. [1]

(d) Form an equation in terms of x and show that it simplifies to $3x^2 - 124x + 825 = 0$. [2]

(e) Solve the equation to find the values of x .
Given that the cost per crate is above \$20, find the cost of one durian. [3]

6. (a) A fruit dealer supplies 4 kinds of fruit, namely apple (A), orange (B), mango (C) and pineapple (D). Delivery is made to three shops.

Shop X receives 400 of A, 600 of B, 70 of C and 50 of D,

Shop Y receives 90 of A, 300 of B, 100 of D,

Shop Z receives 300 of A, 400 of B and 80 of C.

The price of one fruit of A, B, C and D is 35 cents, 20 cents, 45 cents and 30 cents respectively.

$$\text{Given } F = \begin{pmatrix} 400 & 600 & 70 & 50 \\ 90 & 300 & 0 & 100 \\ 300 & 400 & 80 & 0 \end{pmatrix} \text{ and } N = \begin{pmatrix} 35 \\ 20 \\ 45 \\ 30 \end{pmatrix}$$

(i) Find FN . [2]

(ii) Explain clearly what the numbers in FN represent. [1]

(iii) During a particular month, shop X receives 30 similar deliveries, shop Y receives 28 deliveries and shop Z receives 25 deliveries. Using matrices, find the total amount of money the dealer receives from the sale of all the fruits to the 3 shops during this month. [2]

- (b) $\varepsilon = \{x: x \text{ is a whole number and } 1 < x \leq 10\}$
 $A = \{x: x \text{ is a prime number}\}$
 $B = \{x: x \text{ is an odd number}\}$

(i) Draw a Venn diagram to represent these sets. [1]

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

(iii) Find the value of

(a) $n(A)$, [1]

(b) $n(A \cup B)'$. [1]

7. (a) Tom came to Singapore from Auckland. He decided to stay in York Hotel. The rate as advertised on internet was S\$360 per day. This was exclusive of the 10% service charge and 7% GST.

(i) Calculate, in Singapore dollars, the amount he had to pay if he stayed in the Hotel for 1 week, correct to the nearest dollar. [2]

(ii) Express the sum of service charge and GST as a percentage of the total cost he had to pay. Correct your answer to the whole number. [2]

(iii) At Suntec Shopping Mall, he paid a GST amount in Singapore dollars of \$129.50 for the camera. Find, in Singapore dollars, the cost of the camera assuming no discount was given for the camera. [1]

(iv) The exchange rate was 1 NZ dollar to Singapore dollars 1.087. Calculate how much he could refund the GST in NZ dollars for the camera when he left Singapore. [1]

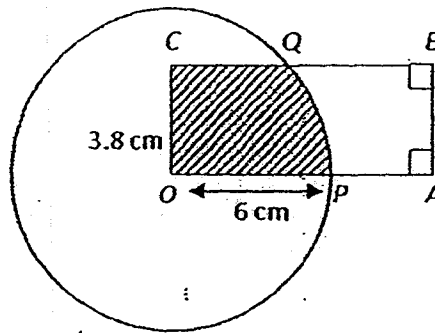
- (b) Mr Lim wishes to buy a new car which is priced at \$125 000. Mr Lim trades in his old car for \$46 350 and pays a sum of down payment. He borrows the remaining amount from a finance company which charges a simple interest at the rate of 2.4% per annum. Mr Lim is only allowed to pay the loan in 5 years and he can only afford to pay each monthly installment by not more than \$1 200. Calculate

(i) the total possible maximum amount of installments he can afford to pay for the loan, and [1]

(ii) the least amount he has to pay for the down payment in cash, giving your answer to the nearest thousand dollar. [3]

(iii) Mr Lim drove the car for a distance of 1154 km. He spent \$258.25 on petrol which cost \$2.34 per litre of petrol. Calculate the efficiency of the car which is measured by the amount of distance travelled per litre of petrol consumption by the car. [2]

8. (a)



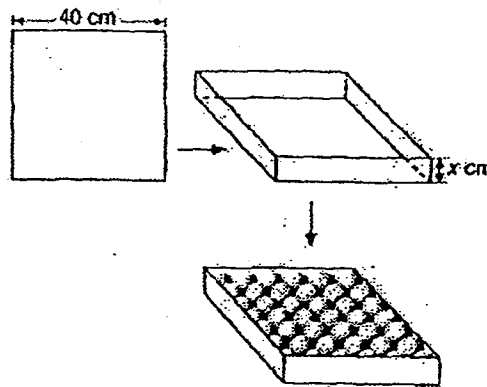
Given $OABC$ is a rectangle and the width of the rectangle is 3.8 cm. The radius of the circle centre O is 6 cm. The circle intersects with the rectangle at point P and Q .

(i) Show that $\angle POQ = 0.686$ radian. [2]

(ii) Find the length CQ . [1]

(iii) Calculate the area and the perimeter of the shaded region. [4]

(b) A square cardboard of side 40 cm is folded to form an open rectangular box by cutting away 4 squares at its corners. The length of each square is x cm. Given that the total external surface area of the box is 1536 cm^2 .



(i) Show that $x = 4$ cm. [2]

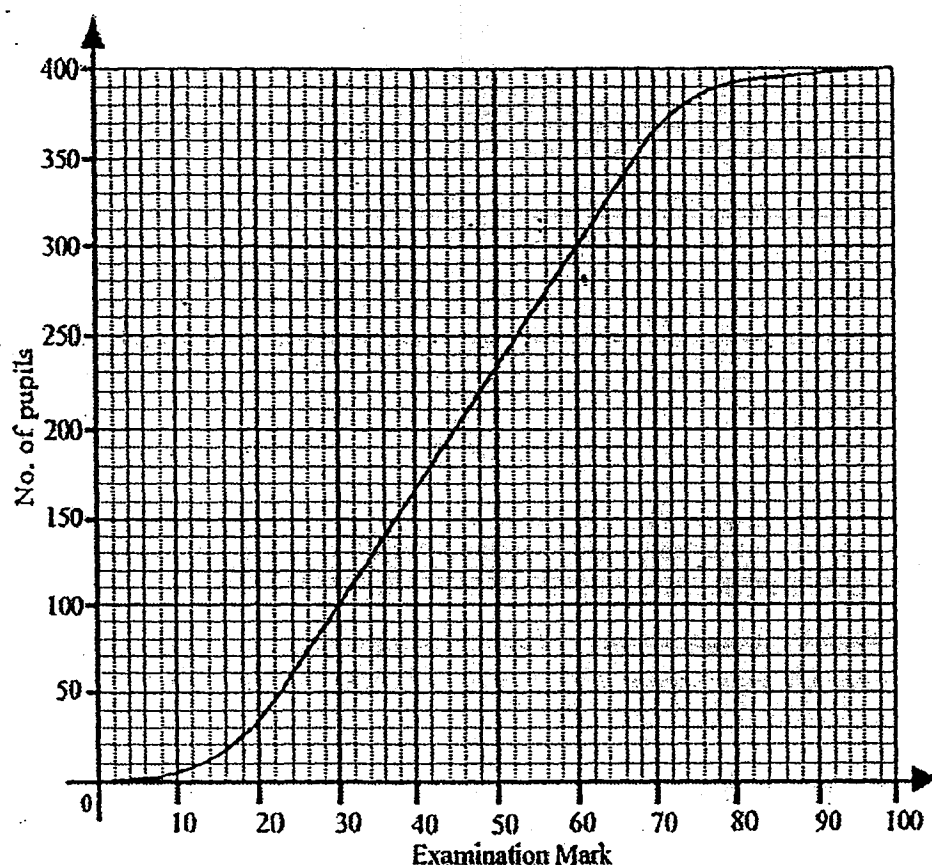
A layer of identical spheres with radii 1.5 cm are put into the box row by row.

(ii) How many spheres can be put into the box? [2]

(iii) Water is now poured into the box. Find the volume of water used to fill the box to brim full. [2]

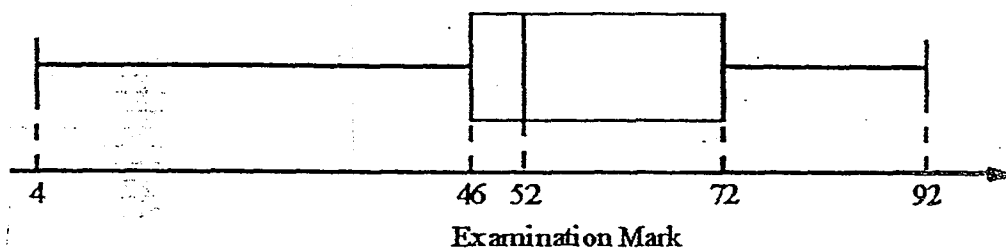
(iv) If the spheres are now removed from the box, find the depth of water in the box. [1]

9. The diagram below shows the cumulative frequency curve for the marks of 400 pupils who sat for a Mathematics examination.



- (a) Use the graph to find
 (i) the median mark, [1]
 (ii) the interquartile range. [1]
- (b) The top 5% of the pupils is enrolled into a Cambridge Mathematics Competition. Using the graph state the lowest mark of the pupils which qualify for this competition. [1]
- (c) If two pupils are selected at random from these pupils of the top 5%, find the probability that both of them scored mark over 78. [2]

- (d) The same 400 students also sat for a Science examination. The box and whisker diagram below illustrates the marks obtained.



Use the diagram to find

- (i) the median marks, [1]
 (ii) the interquartile range. [1]
- (e) Compare the marks obtained by the 400 students for the Mathematics and Science examinations in two different ways. [2]

10. Answer the whole of this question on a sheet of graph paper.

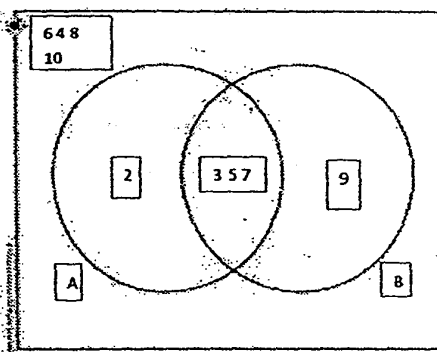
The variables x and y are connected by the equation $y = 6x^2 - x^3 - 8x$.
 The table below shows some values of x and the corresponding values of y , correct to 1 decimal place.

x	0	0.5	0.8	1.5	2.0	2.5	3.0	3.5	4.0	4.3
y	0	-2.6	-3.1	-1.9	0	p	3.0	2.6	q	-3.0

- (a) Find the values of p and q , correct to 1 decimal place. [1]
- (b) Using a scale of 4 cm to represent 1 unit on the x -axis and 2 cm to represent 1 unit on the y -axis, draw the graph of $y = 6x^2 - x^3 - 8x$ for $0 \leq x \leq 4.3$. [3]
- (c) (i) By drawing a tangent, find the gradient of the curve at $x = 0.5$. [2]
 (ii) Write down the range of values of x for which the gradient of the curve is a positive value. [1]
- (d) By drawing a suitable straight line on the same axes, use your graph to estimate the greatest value of x , correct to 2 decimal place, that will satisfy the equation $6x^2 - x^3 - 9x + 1 = 0$. [3]

— The End —

Answer key

1.	a.	$\frac{8x-3}{(x+1)(x-1)}$	2.	a.	i) $AB = 237m$ ii) $MB = 365m$
	b.	2.20 or -0.45		b.	i) $BD = 152m$ ii) 67.3° iii) $AE = 155m$
	c.	$(x+y)(x-y)(3x+2)(3x-2)$			
	d.	$y = \frac{24x}{4-3x}$			
3.	a.	100^0	4.	a.	i) $6a$
	b.	39^0			ii) $3b + 4a$
	c.	80^0			iii) $8a+6b$ or $2(4a+3b)$
5.	a.	Cost price of each durian = $\$(\frac{x}{15})$		b.	$AX = AC$ Therefore A, X and C are collinear
	c.	Total S.P. = $\$5(450 - \frac{1650}{x})$ = $\$(2250 - \frac{8250}{x})$		c.	$8cm^2$
	e.	cost of 1 durian = $\frac{33}{15} = \$2.20$		d.	$\frac{\text{triangle } ABX}{\text{triangle } CBP} = \frac{2}{3}$
6.	ai)	$\$ \begin{pmatrix} 306.50 \\ 121.50 \\ 221 \end{pmatrix}$ or $\begin{pmatrix} 30650 \\ 12150 \\ 22100 \end{pmatrix} \text{¢}$	6.	b.	$E = \{2, 3, 4, 5, 6, 7, 8, 9, 10\}$ i) $A = \{2, 3, 5, 7\}$ $B = \{3, 5, 7, 9\}$
	ii)	The numbers represent the total price of all fruits delivered to each of the shops.			
	iii)	$\$18122$			ii) $(A \cap B)' = \{2, 4, 6, 8, 9, 10\}$ iii a) $n(A) = 4$ iii b) $n(A \cap B) = 4$
7.	a.	i) $\$2966$ ii) 15% iii) $\$1850$ iv) $NZ\$119.14$			
	b.	i) $\$72000$ ii) $\$15000$ iii) 10.5 km/litre			
8.	a.	ii) $CQ = 4.64cm$ iii) 18.6 cm			
	b.	ii) Number of spheres in the book = 100 iii) 2680 cm^3 iv) $2.62cm$			
9.	a.	i) 45 ii) 30			
	b.	74			
	c.	$9/38$ or 0.237			
	d.	i) 52 ii) 26			
	e.	Median of Science (52) is higher than median of Mathematics (45), implies that overall the students done better in science. IQR of science (26) smaller than IQR of Mathematics (30), implies that overall the students performed more consistently in science.			

10.

(a) $p=1.9, q=0$ (b) i) $m=-2.75$ ii) $0.85 < x < 3.15$ (d) add a line $y=x-1$
 $x=0.15, 2.35, 3.55$ 