FAIRFIELD METHODIST SECONDARY SCHOOL

End - of - Year Examination 2006
SECONDARY 3 Express

MATHEMATICS   4017/ 1

Paper 1

Date: 9th October 2006   Time: 2 hours

NAME: _____ (   ) CLASS: _____

INSTRUCTIONS TO CANDIDATES

Write your name, class and index number in the spaces provided in the spaces at the top of the page.

Answer **ALL** questions.

Write your answers in the spaces provided on the question paper.

If working is needed for any question it must be shown in the spaces below that question.

ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each or part question.

You should not spend too much time on any one question.

For Examiners' Use	
Paper 1	/ 80
Paper 2	/ 100
Total	%

This question paper consists of <u>17</u> printed pages.

1.   Evaluate   .

(a) $\dfrac{25}{4} - 1\dfrac{3}{4}$

(b) 1.2×0.5

(c) $31.0005 - 2.5$

Answer (a) _____ [1]

(b) _____ [1]

(c) _____ [1]

2.   (a)   Evaluate $\sqrt{0.0081}$.

(b)   Given that $\dfrac{22.3 \times 0.12}{0.122 \times 3.32} = 6.60675$, find the value of $\dfrac{0.223 \times 1.2}{12.2 \times 0.332}$.

Answer (a) _____ [1]

(b) _____ [2]

3   (a)   Given that $-3 \le x \le 2$ and $-1 \le y \le 10$, find the

      (i)   the greatest value of $x + y$,

      (ii)   the least value of $y - x$,

      (iii)   the least value of $x^2 - y$.

   (b)   Solve the inequality

$$2x - 1 \le x + 2 \le 3 - x.$$

Answer (a) (i)_____ [1]

(ii) _____ [1]

(iii)_____ [1]

(b) _____[3]

4.   Factorise completely

    (a) $8a - 4a^2$,

    (b) $25y^2 - 4$,

    (c) $2x^2 + 6xz + 5xy + 15yz$.

Answer (a) _____ [1]

    (b) _____ [1]

    (c) _____ [2]

5.   Find the exact value of

    (a) $36^{\frac{1}{2}} - 125^{\frac{2}{3}}$,

    (b) $\left(\dfrac{121}{32}\right)^{0} \times \left(\dfrac{12}{1248}\right)^{-1}$.

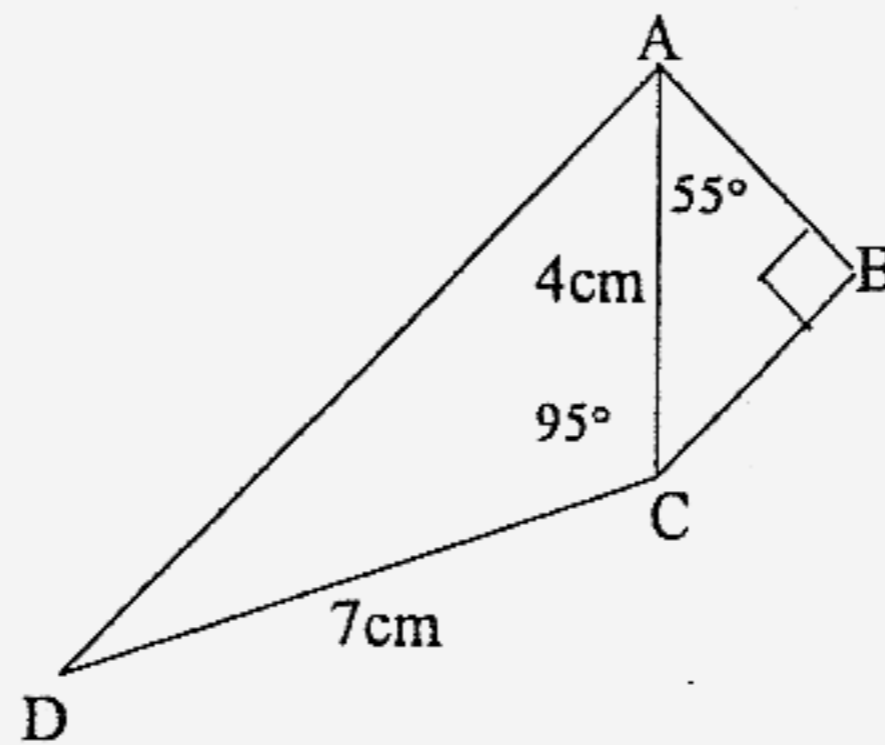Answer (a) _____ [1]

    (b) _____ [2]

6.   The diagram shows a quadrilateral ABCD with CD=7cm, AC= 4cm, ∠CAB = 55°, ∠ACD= 95° and AB perpendicular to BC. Find, using as much as information below as necessary,

(a)   the length of BC,

(b)   the value of sin AĈD,

(c)   the value of AD².

sin 35° = 0.6	cos 35° = 0.8	tan 35° = 0.7
sin 85° = 0.9	cos 85° = 0.1	tan 85° = 11.4

Answer (a) _____[1]

(b) _____[1]

(c) _____[2]

7.   Simplify $\dfrac{5a^{-4}b^7}{6a^4c^{-15}} \div \dfrac{b^{11}c^{-2}}{3b^{-5}c}$, leaving your answer in the positive index form.

Answer _____[2]

_____

8.   It is given that $\sqrt{\dfrac{w+v^2}{s+w}} = u$.

   (a)   Make w the subject of the formula.

   (b)   Find the value of w, when $s = 1$, $u = 2$ and $v = -3$.

Answer (a) _____[2]

(b) _____[1]

9.   Mr Wesley is a well known tour agent working in Golden Tours Pte Ltd. He earns a commission for every tour package he sells. He saves a portion of his commission every month. His monthly savings, S, is inversely proportional to the square root of his monthly commissions, C. He gets $81 and $144 as commission for the months of September and October 2006 respectively. If the difference of his monthly savings for the two months is $120, calculate the amount he saved in October 2006.

Answer _____ [3]

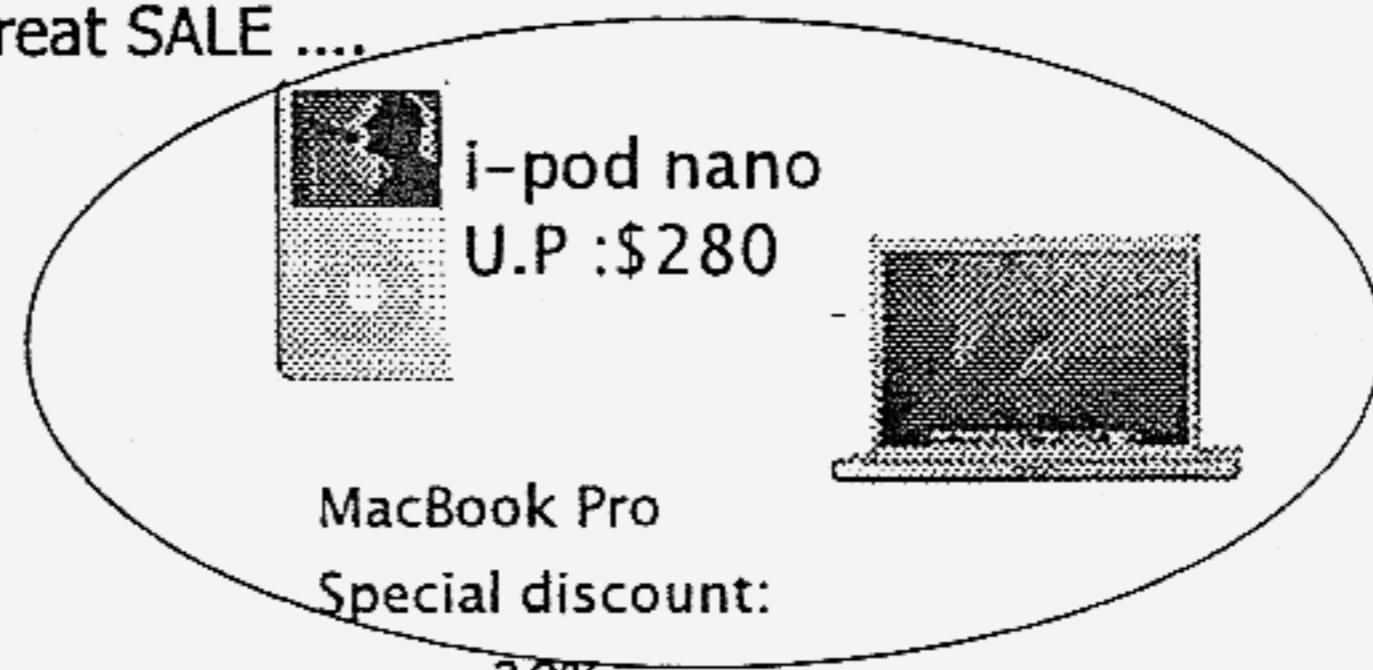10.   Solve the simultaneous equations

$$2x + 3y = 1,$$
$$x - 4y = 17.$$

Answer $x =$ _____

              $y =$ _____ [3]

11.   Part of an advertisement of Apple's annual sale is shown below.

Apple's Great SALE ....

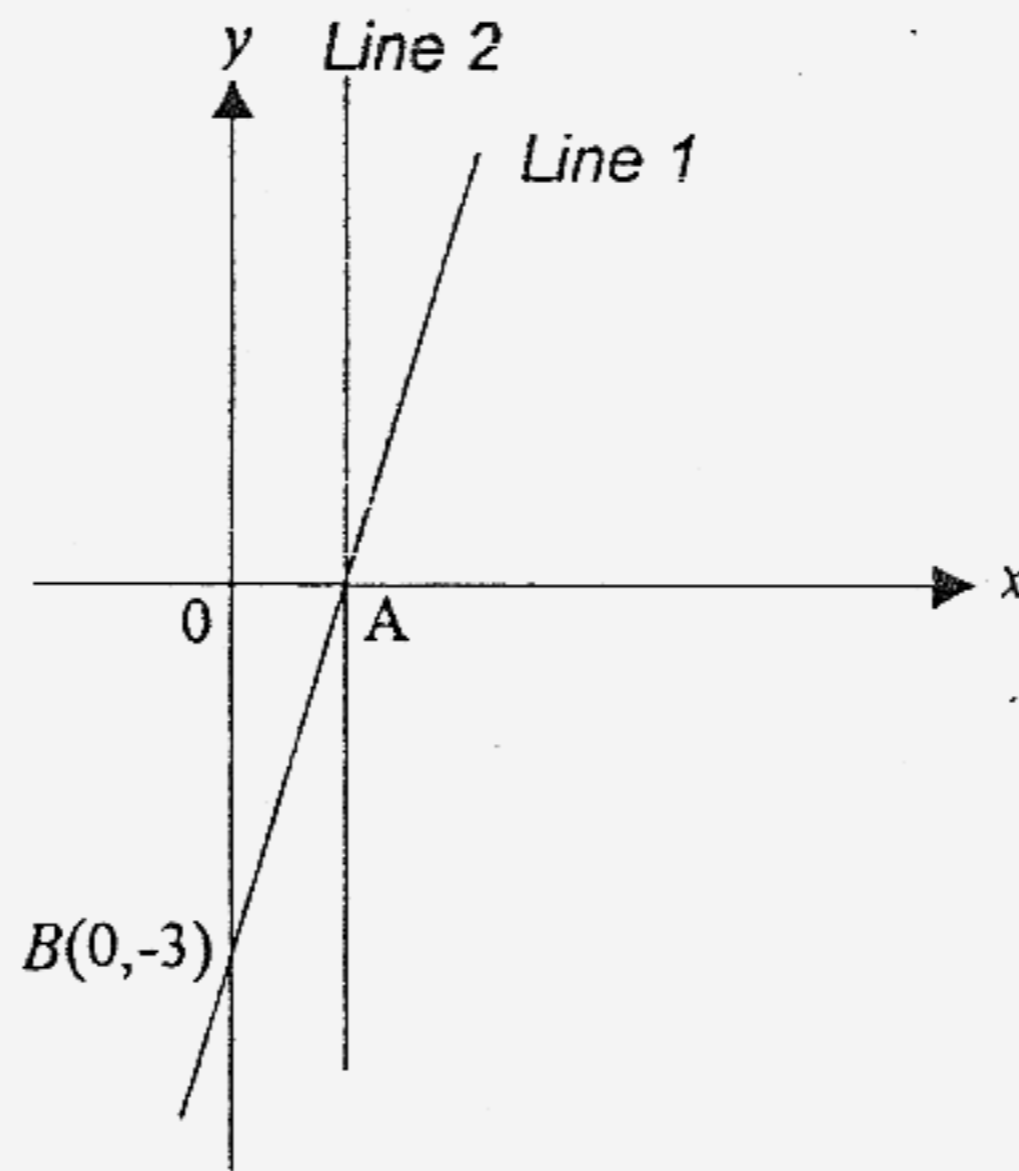i-pod nano
U.P : $280

MacBook Pro
Special discount:

(a)   Spencer managed to purchase an i-pod nano at $210 during the sale.
       Calculate the percentage discount.

(b)   In the same sale, he also bought a MacBook Pro at $3200. Calculate its
       original price.

Answer (a) _____ [1]

              (b) _____ [1]

12.   In the diagram below, Line 1 cuts the y-axis at B(0,-3), and is parallel to the line $y = 3x - 4$. Line 2 meets Line 1 at point A on the x-axis.

(a)   Find the equation of Line 1.

(b)   Write down the equation of Line 2.

(c)   Annette mentioned that a point C (-2,-5) is collinear to the points A and B. Is her claim correct? Justify your answer with proper working.
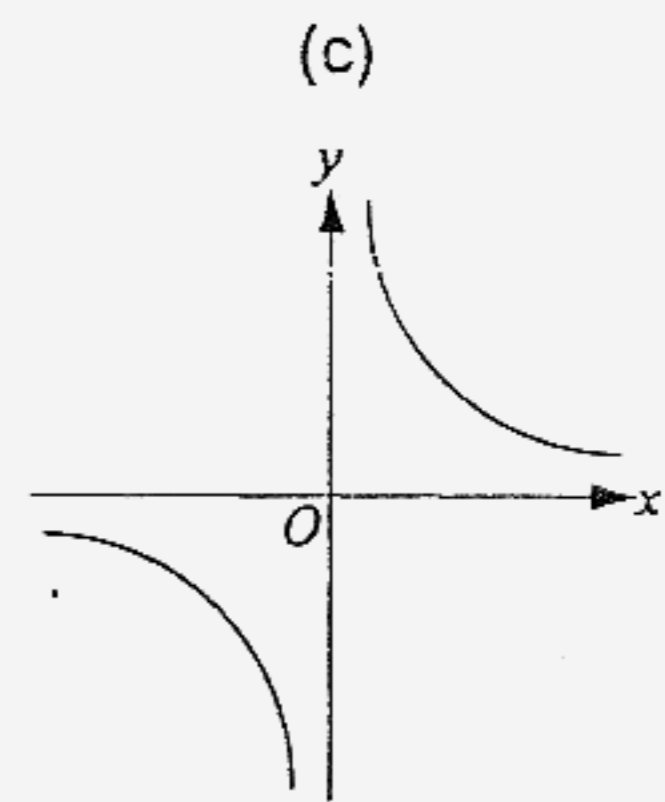
Answer (a) _____[1]

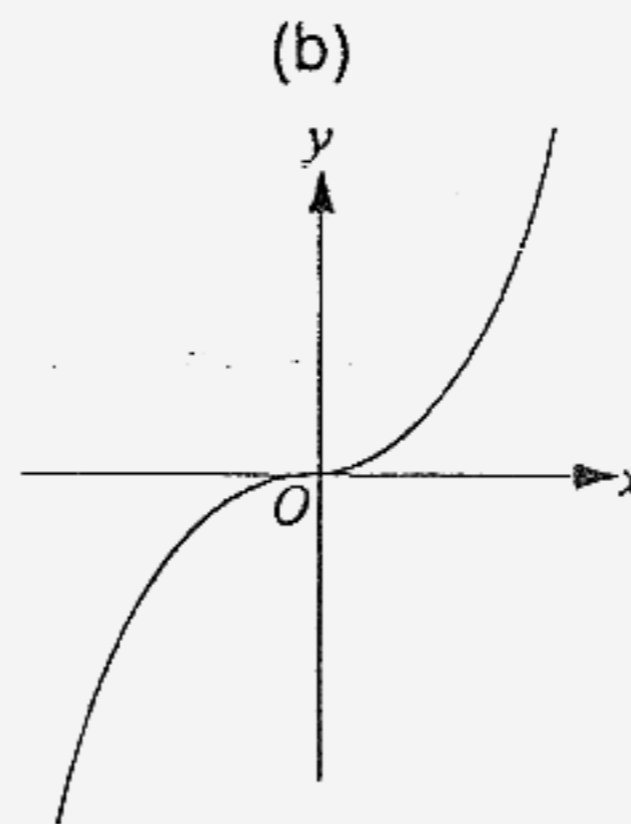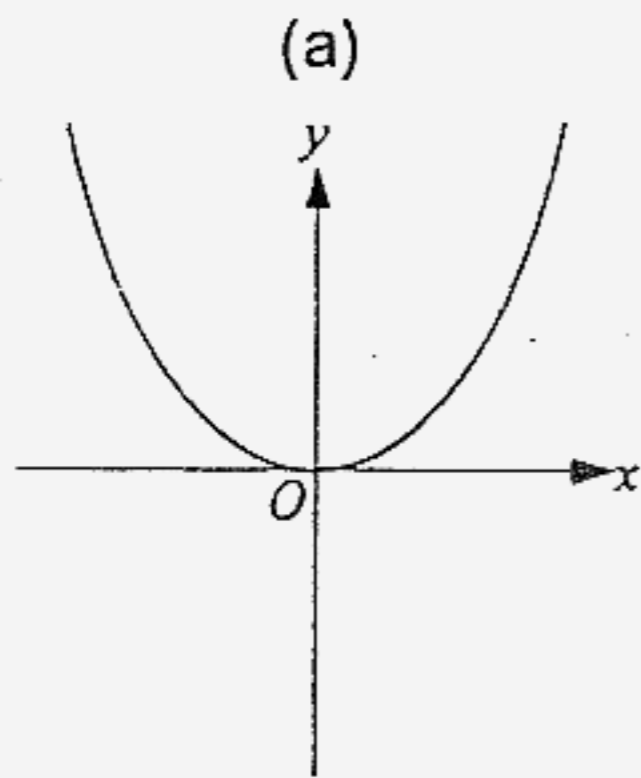(b) _____[1]

(c)

[2]

13.   The equations of the graphs shown below are of the form $y = x^n$, where n is an

integer.

State a possible value of n in each case.

(a)   (b)   (c)
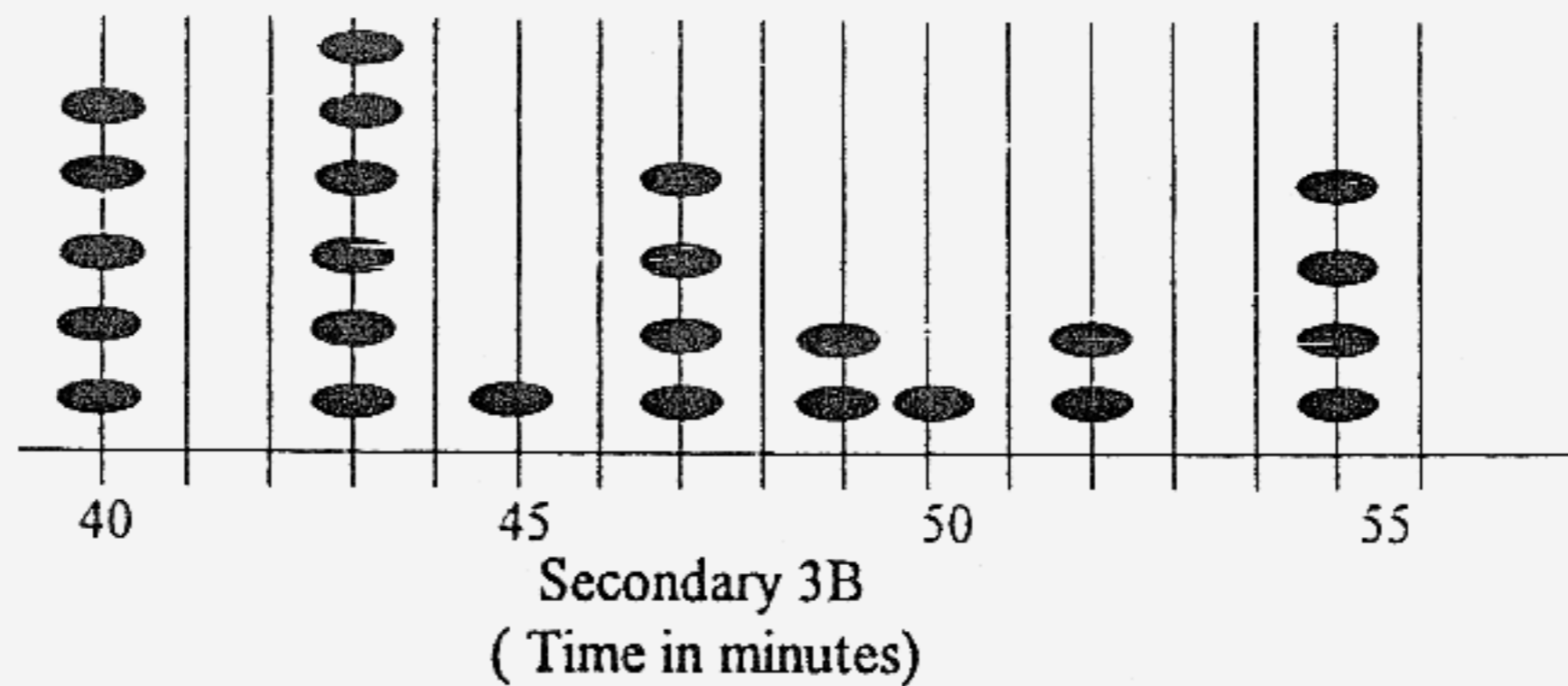

Answer (a) _____[1]

(b) _____[1]

(c) _____[1]

14.   Express $\dfrac{2}{9 - x^2} - \dfrac{3}{x - 3}$ as a single fraction in its simplest form.

Answer _____[2]

15. Sophia and Benedict were given the task of recording the times taken by the pupils of Secondary 3B to complete a personalised flag each for the coming National Day Celebrations. They decided to present their times in a dot diagram as shown below.

Secondary 3B
(Time in minutes)

(a) Represent the above data in the form of a single ordered stem and leaf diagram.
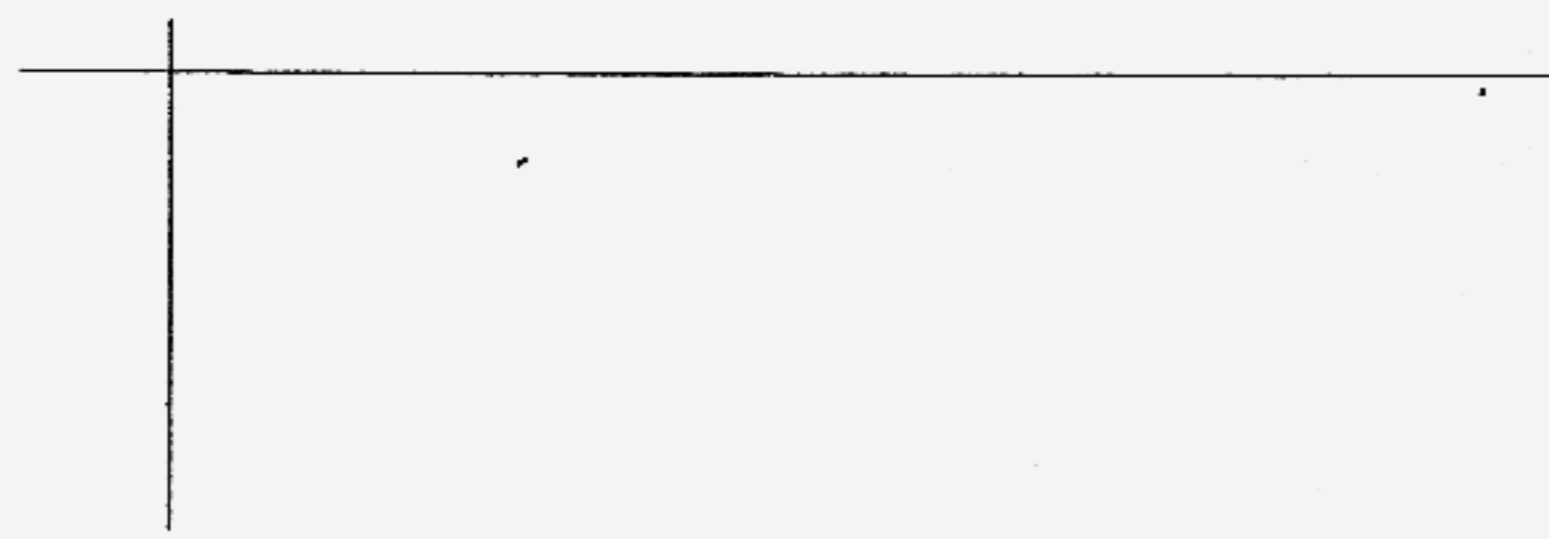
[2]

(b) They were then instructed by their Mathematics teacher to calculate the average time taken by a pupil to complete the personalised flag. Sophia immediately responded that the average time taken by a pupil was 43 minutes. However, Benedict disagreed and said that the average time taken by a pupil was 47 minutes.

Comment on their claims and explain what their average times represent.

(Show working to support your answer)

Answer

(b)

[2]

16.   The diagram below shows the speed-time graph of a particle moving in a straight line for 28 seconds.

Speed (v) in m/s

Time (t) in seconds
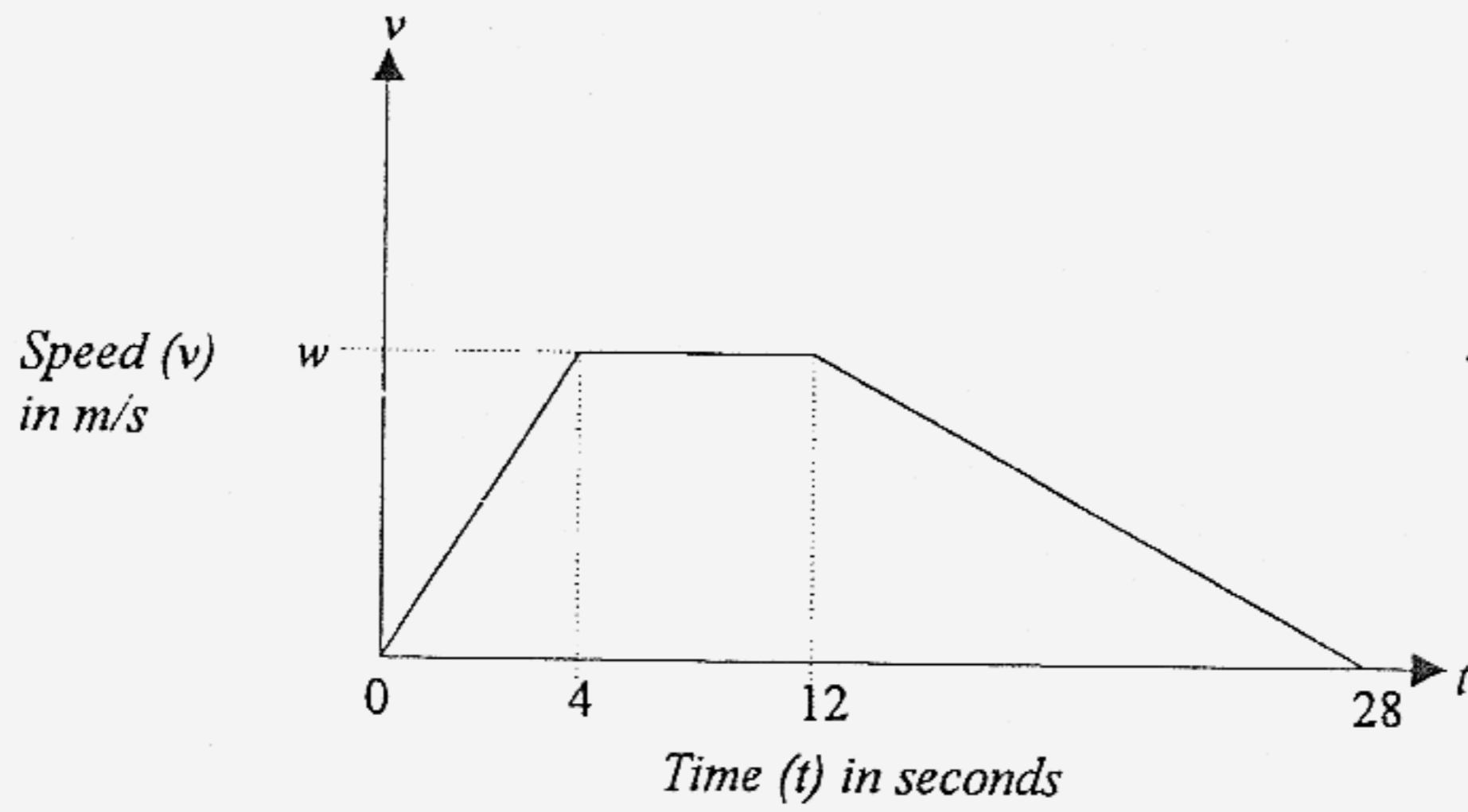
(a)   Given that the particle travelled 80 metres during the last 16 seconds, find the value of w.

(b)   Find the acceleration when $t = 18$.

(c)   Find the speed when $t = 21$.

Answer (a) _____[1]

(b)_____[1]

(c)_____[2]

(d)   On the axis below sketch the distance-time graph of the particle's movement.
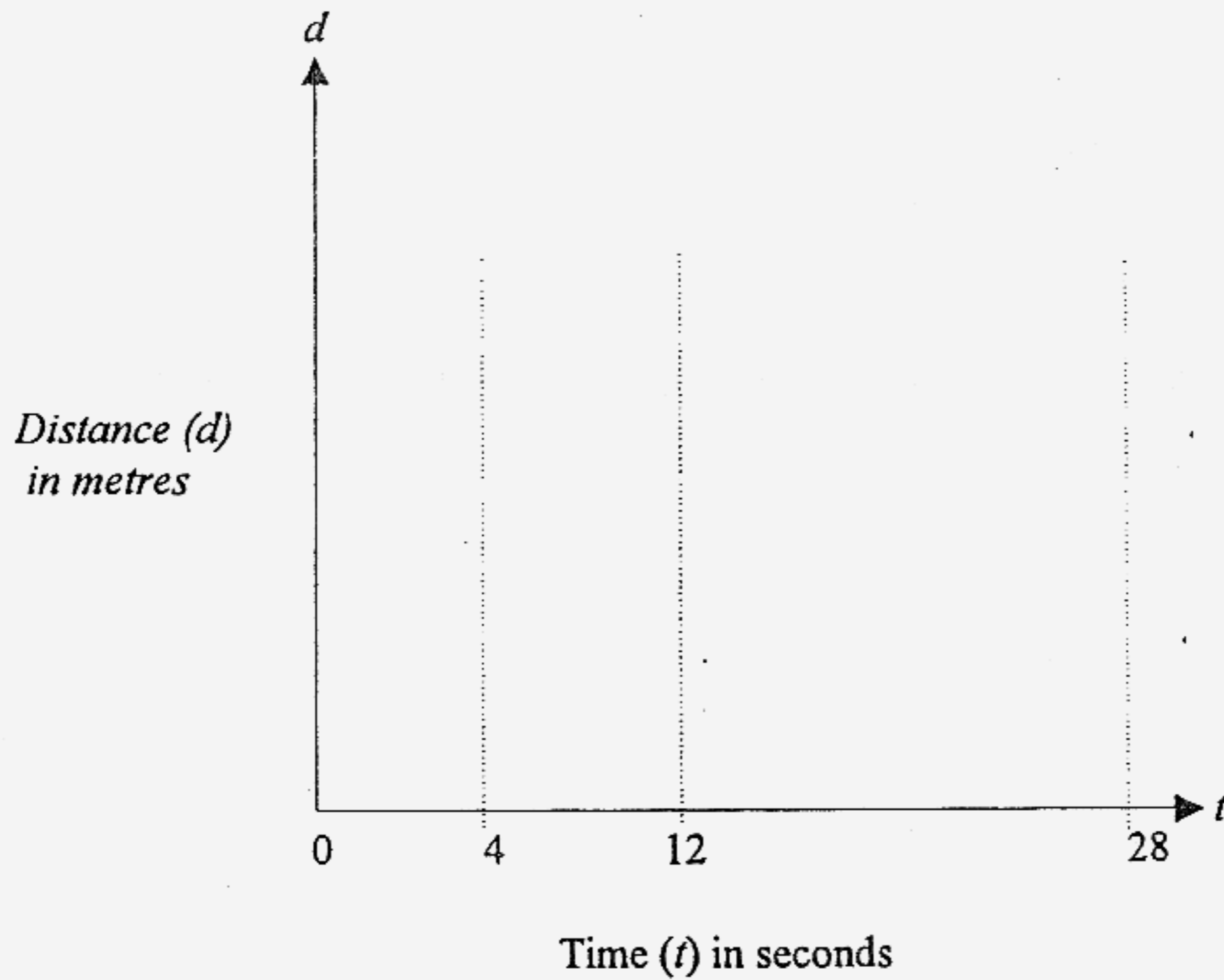
Time (*t*) in seconds   [3]

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17.   In the diagram, A, B and C represent three points on a map. Calculate

(a) the bearing of B from A,

(b) the bearing of C from B.

Answer (a) _____ [1]

(b) _____ [1]
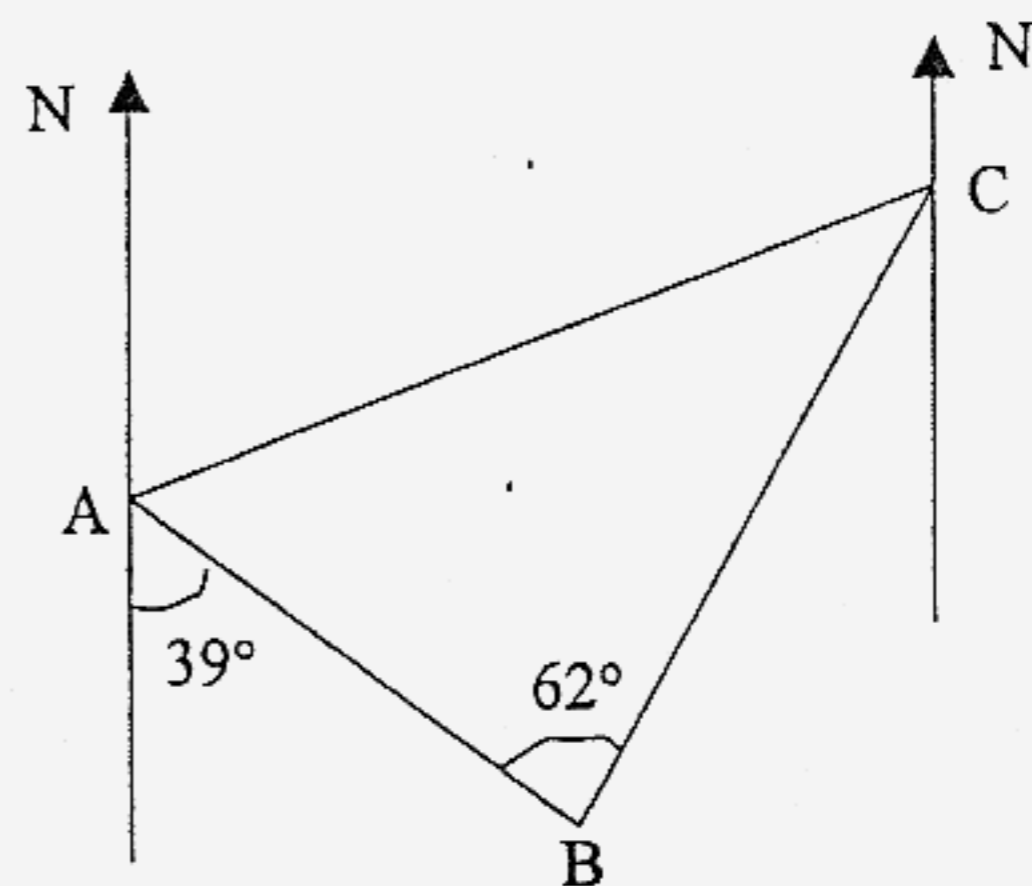
18. In the following figures, shade

    (a) 1 small rectangle so that the resulting figure has exactly one line of symmetry.
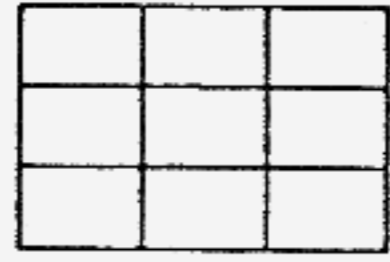
                                                                            [1]

    (b) 2 triangles so that the resulting figure has rotational symmetry of order 2.
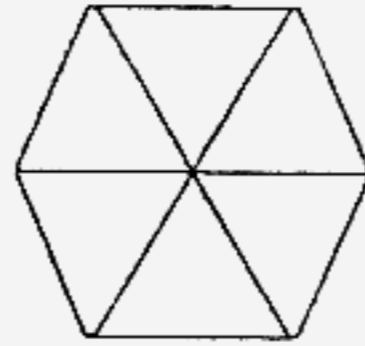
                                                                            [1]

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19. Solve

$$3x - \frac{4}{x} = 11.$$

                                                 Answer _____[3]

20   (a)   A regular polygon has n sides. The size of each interior angle is 7 times the size of each exterior angle. Calculate

           (i)   the size of each interior angle,

           (ii)   the value of n.

   (b)   Write down the value of $\dfrac{\text{the size of an exterior angle of a decagon}}{\text{the size of an exterior angle of an hexagon}}$.

Answer (a)(i)_____[1]

(ii)_____[1]

(b)_____[1]

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21.   Solve the following equations.

   (a) $\dfrac{1}{2^{y}} = 1$

   (b) $3^{x} \div 3^{3x} = 27$

   (c) $16^{x+1} \times 4^{2x} = 64^{1-x}$

Answer (a) _____[1]

(b) _____[2]

(c) _____[2]

22.   The map of the Singapore Zoological Gardens is drawn to the scale of 2 cm to 800m. Jarold decided to cycle from the Primate Kingdom to the Fragile Forest which is 4 km apart. Along the way he decided to stop near a lake, which is 9 cm^2 in area on the map, to take a rest.

(a)   Express the scale in the form of 1: n.

(b)   Calculate, in cm, the distance between the Primate Kingdom and the Fragile Forest on the map.

(c)   Calculate, in km^2, the actual area of the lake.

Answer (a) _____[1]

(b) _____[1]

(c) _____[2]

23.   Dorcas decided to design a Teachers' Day card for her favourite teacher. She cut out a minor sector and a major sector from a cardboard. She joined the minor sector, OBC, with the major sector, OAD, to form the shape as shown in the diagram below. It is given that AB = CD = 4 cm, O is the centre of a circle of radius 5 cm and angle AOD = 36°.

Leaving your answers in terms of π,

(a)   calculate the area of the card,

(b)   calculate the perimeter of the card.
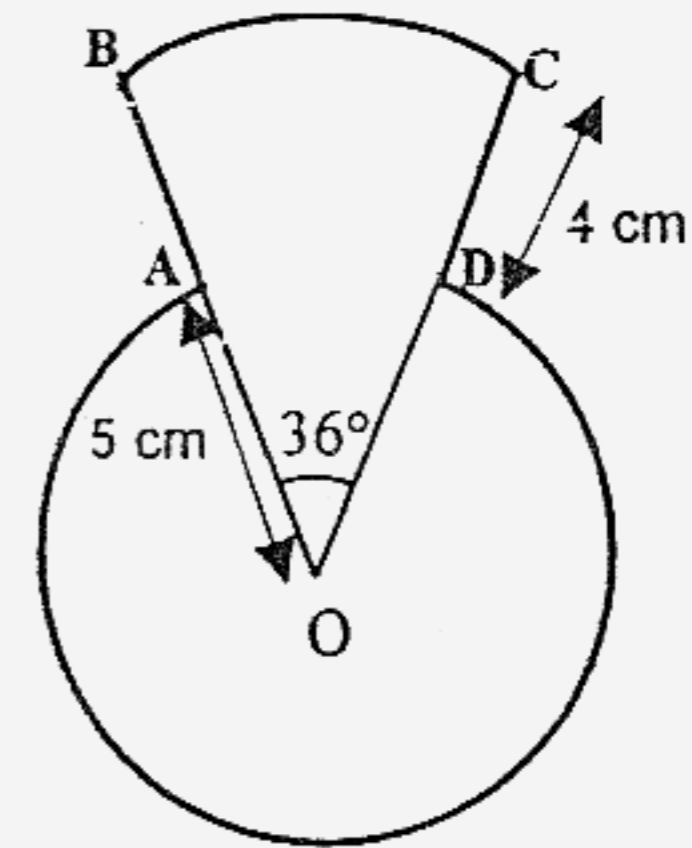
Answer   (a) _____

                  (b) _____ [5]

FAIRFIELD METHODIST SECONDARY SCHOOL

SECONDARY 3 Express
End-Of-Year Examination

MATHEMATICS   **4017/2**
PAPER 2

Wednesday   **4 October 2006**   100marks

Additional materials: Answer Paper
                      Electronic calculator
                      Geometrical instruments
                      Graph papers

TIME   2 hours 30 minutes

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate Answer Booklet/Paper provided.
Write your name, class and index number in the spaces provided on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **ALL** questions in this paper.

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.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 100.
You are expected to use an electronic calculator to evaluate explicit numerical expressions.
You may use mathematical tables as well if necessary.
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 or 3.142, unless the question requires the answer in terms of π

This question paper consists of <u>11</u> printed pages

Answer ALL questions

1 (a) Evaluate $\dfrac{3.795^2}{\sqrt[3]{42.5} + \sqrt{2.86}}$, giving your answer correct to 4 significant figures.   [1]

(b) Two batches of concrete are made using different mixtures of sand, cement and water. In **batch A,** the ratio of the masses of sand : cement : water is 9 : 2 : 1, while in **batch B,** this ratio is 17 : 5 : 2.

   (i)   A truck contains 4000 kg of **batch B** concrete. Calculate the mass of sand in this batch of concrete.   [2]

   (ii) 1000 kg of **batch A** concrete is added to 1000 kg of **batch B** concrete to make a new concrete mixture. Find the ratio of the masses of sand : cement : water in this new mixture.   [2]

(c) A load of mass m kg can be safely carried by a chain of thickness t cm. m varies directly as the square of t. It is known that when $t = 3$, $m = 4500$.

   (i)   Write down an equation connecting m and t.   [2]

   (ii) Find the minimum thickness of the chain to withstand a load of 6480 kg.   [1]

   (iii) What is the mass of the load which can be safely carried by a chain of thickness of 2.5 cm.   [1]

2 P(-2, 10), Q(-6, 0) and R(4, 4) are vertices of a rhombus PQRS.

   (a) Calculate the coordinates of M, the midpoint of PR, and hence find the coordinates of S.   [3]

   (b) Find the equation of the line PR   [2]

   (c) Calculate the length PR and hence find the area of the rhombus PQRS.   [4]
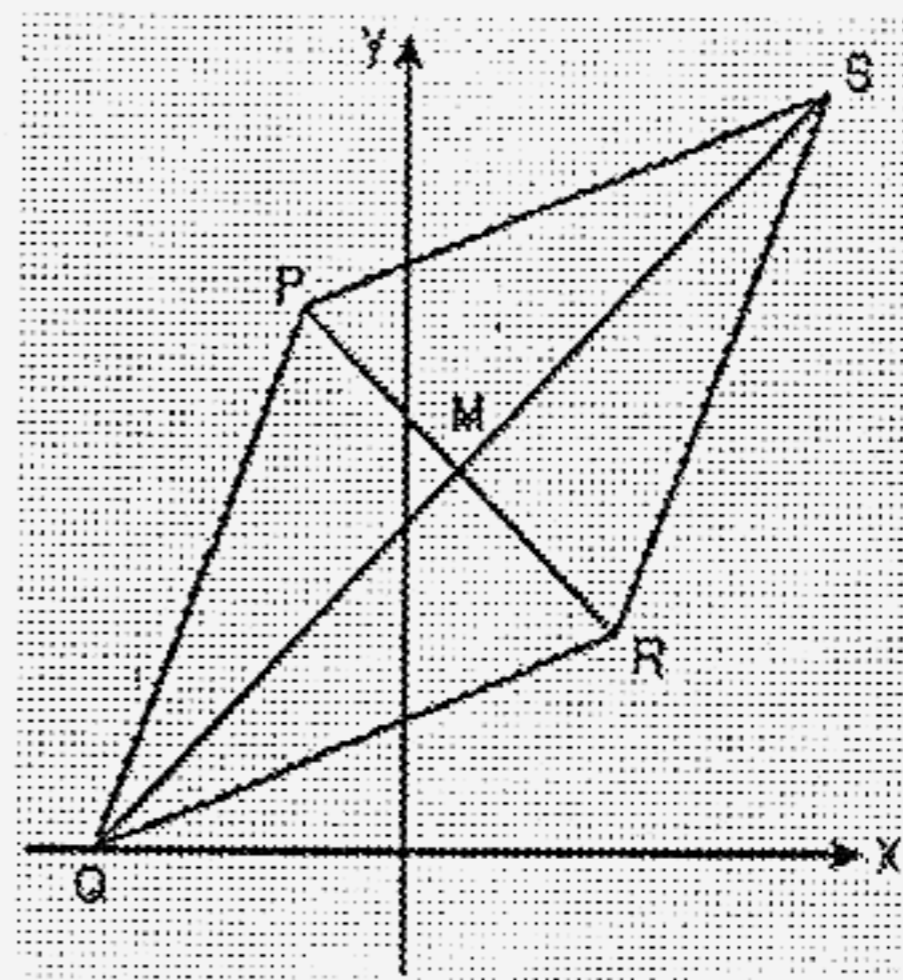
3 Two sisters, Megan and Nicole, went to America in 2005 for a holiday. The table below shows the exchange rates of a bank for 2005:

Singapore dollars to one unit of foreign currency	Buying	Selling
Thai Baht	0.041	0.043
Hong Kong Dollar (HK$)	0.20	0.21
Australian Dollar (AUD)	1.18	1.20
US Dollar (US$)	1.57	1.59

(a) The two sisters converted S$3 000 to US dollars. Calculate the amount of US dollars they received, giving your answer to the nearest US dollars. [2]

(b) While in America, they hired a car and travelled 2335 km, spending a total of US$89 on petrol. Given that a litre of petrol cost US$0.42 in America, calculate the petrol consumption of the car in litres per kilometre. [2]

(c) Nicole bought a bag for US$180. Back in Singapore, she saw the same bag selling at S$300. State with reasons whether or not she had made a good buy. [2]

(d) (i) Due to the hike in oil prices, the price of an air ticket to America in 2004 was 4% higher than that in 2003. The price in 2005 was 3% higher than that in 2004. What was the percentage increase in the price of air ticket to America from 2003 to 2005? [2]

(ii) The price of an air ticket to America cost $1700 in 2005. What was the price of a ticket to America in 2003. [1]

4 The Central Provident Fund (CPF) is a social security savings plans for Singaporeans and permanent residents. Every working Singaporean and permanent resident has to contribute a certain percentage of his /her monthly income to the CPF. The amount of contribution to the CPF is dependent on age. Every employer also has to make a contribution to the CPF.

The table below gives the contribution rates in 2005 for the various age groups.

Employee Age (y years)	Contribution By Employer (% of income)	Contribution By Employee (% of income)	Total Contribution (% of income)
$y < 35$	13	20	33
$35 \leq y < 45$	13	20	33
$45 \leq y < 50$	13	20	33
$50 \leq y < 55$	9	18	27
$55 \leq y < 60$	6	12.5	18.5
$60 \leq y < 65$	3.5	7.5	11
$y \geq 65$	3.5	5	8.5

(a) Mr Lim is 28 years old and he works as a supervisor in a factory earning a monthly income of $1650. Calculate his take home pay after deducting CPF.   [2]

(b) Mr How is a retired teacher re-employed by the government to teach technical studies in a secondary school. If he is 62 years old and earns $4300 per month, calculate his total contribution to his CPF account for the period from January 2005 to June 2005. [2]
[Total contribution to employee's CPF account is the sum of contribution by employer and contribution by employee.]

(c) A trading company has a staff strength of 60 consisting of 46 employees who are 50 years old and below, 9 employees who are between 50 and 55 years old and the remaining staff who are between 60 and 65 years old. If every employee earns $2500 per month, calculate how much the company must contribute monthly to the CPF for all its 60 employees.   [3]

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

A railway line between Town A and Town B is 30 km long. A train leaves Town A at 08 00 and travels towards Town B at an average speed of 30 km/h. It stops for 16 minutes at a junction 12 km from Town A and then continues at the same speed to Town B.

(a) Using a horizontal scale of 1 cm to 5 minutes and a vertical scale of 2 cm to 5 km, draw the distance-time graph of the journey of the train from Town A to Town B.

[5]

A car left Town B at a later time and travelled towards Town A on a road that was also 30 km long. It travelled at a steady speed of 60 km/h. It stopped at a junction 10 km from Town B because the train in part (a) was crossing the junction. After a delay of 8 minutes, the car continued its journey at the same speed and arrived at Town A at 0920.

(b) Using the same scales and on the same axes in part (a), draw the distance-time graph for the journey of the car. [3]

(c) Find the time at which the car left Town B. [1]

6 Wilson is planning an expedition to reach the summit of Mountain Ophir.

He investigates three possible routes — P, Q and R.

(a) If he travels on route P, which is 20 km long, he expects to cover x km per day.

Route Q, which is 5 km longer than route P, has more challenging wind conditions and he could expect to cover only $(x - 1)$ km per day.

Route R, which is the same distance as route P, has easier wind conditions and he would expect to cover $(x + 1)$ km per day.

Write down an expression, in terms of x, for the number of days that he expects to take on

(i)   route P,

(ii)   route Q,

(iii)   route R.   [3]

(b) He estimates that route Q will take 4 days more than route R. Form an equation in x, and show that it reduces to $4x^2 - 5x - 49 = 0$.   [3]
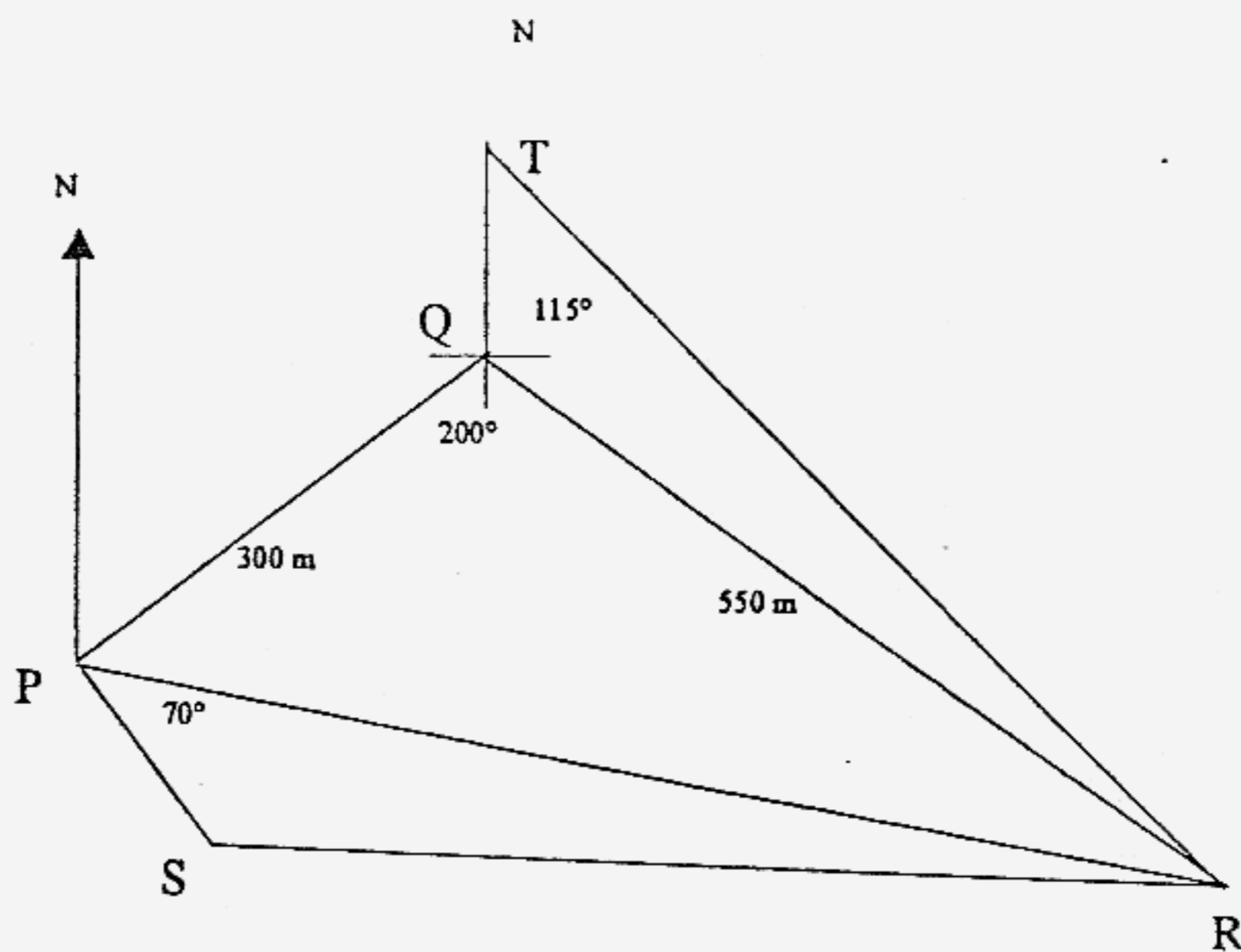
(c) Solve the equation $4x^2 - 5x - 49 = 0$, giving both answers correct to 2 decimal places.   [3]

(d) Calculate the number of days he expects to take on route P.   [1]

7   In the diagram (not drawn to scale) P, Q, R and S represent a plot of land. $PQ = 300$ m , $QR = 550$ m and $\angle RPS = 70°$. The bearing of P from Q is 200°. The bearing of R from Q is 115°. The area of triangle PRS is 30 000m².

(a) Calculate the distance of R from P.   [3]

(b) Calculate the bearing of S from P.   [3]

(c) Calculate the length of PS.   [2]

(d) QT represents a vertical tree at a corner of the land. Esther walks from point P to R. At the point when she is nearest to the tree, the angle of elevation is 13°.

   (i) Find the shortest distance between Esther and the tree.   [2]

   (ii) Find the height of the tree.   [2]

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

The table below gives some corresponding values of x and y, correct to 1 decimal place, of the following equation

$$y = \frac{x^2}{3} + \frac{3}{x} - 6$$

x	1	2	3	4	5	6	7
y	-2.7	-3.2	p	0.1	2.9	6.5	10.8

(a) Calculate the value of p.   [1]

(b) Using a scale of 2 cm to 1 unit, draw the x-axis for $1 \le x \le 7$. Using a scale of 1 cm to 1 unit, draw the y-axis for $-4 \le y \le 12$. Plot the points given in the table and join them to form a smooth curve.   [3]

(c) By drawing a tangent, find the gradient of the graph at the point where $x = 3.5$ [2]

(d) Use your graph to solve the equation $\frac{x^2}{3} + \frac{3}{x} - 6 = 0$ for $1 \le x \le 7$ [2]

(e) On the same axes, draw the graph of $y = 2x - 6$.   [1]

(f) Using your graphs, estimate the range of values of x for which

$$\frac{x^3}{3} - 2x^2 + 3 < 0$$ [2]

9 Dover town council organised a Project Superstar Contest to promote racial harmony among the residents in its town estate. The age group distribution of the 80 participants is given in the frequency table below.

Age in years, x	$15 \le x < 20$	$20 \le x < 25$	$25 \le x < 40$	$40 \le x < 45$
Number of participants	8	22	p	5

(a) Find the value of p. [1]

(b) State the modal class. [1]

(c) Estimate the mean age of the participants of the Project Superstar Contest. [2]

(e) Using a horizontal scale of 2 cm to represent 5 years, and a vertical scale of 4 cm to 1 unit for the frequency density, draw a histogram to illustrate the information in the table above. [3]

10(a) Rectangles are placed to enclose numbers in the number array as shown in the diagram.

1	2	3	4	5	6	.	?	.
2	4	6	8	10	12	.	.	.
3	6	9	12	15	18	.	.	.
4	8	12	16	20	24	.	.	.
5	10	15	20	25	30	.	.	.

The sum of the numbers in the first rectangle, $S_1 = 1 = 1^2$.
The sum of the numbers in the second rectangle, $S_2 = 1 + 2 + 2 + 4 = 9 = 3^2$.

(i) Find S_3 and S_4. [2]

(ii) Find a formula for Sn in terms of n. [1]

(iii) The sum of the numbers in the k th rectangle is 44 100. Find k [1]

10(b)   PQR is a triangle in which $\angle PRQ = \angle RSP = 90°$, PQ = 41 cm and RQ = 40cm.
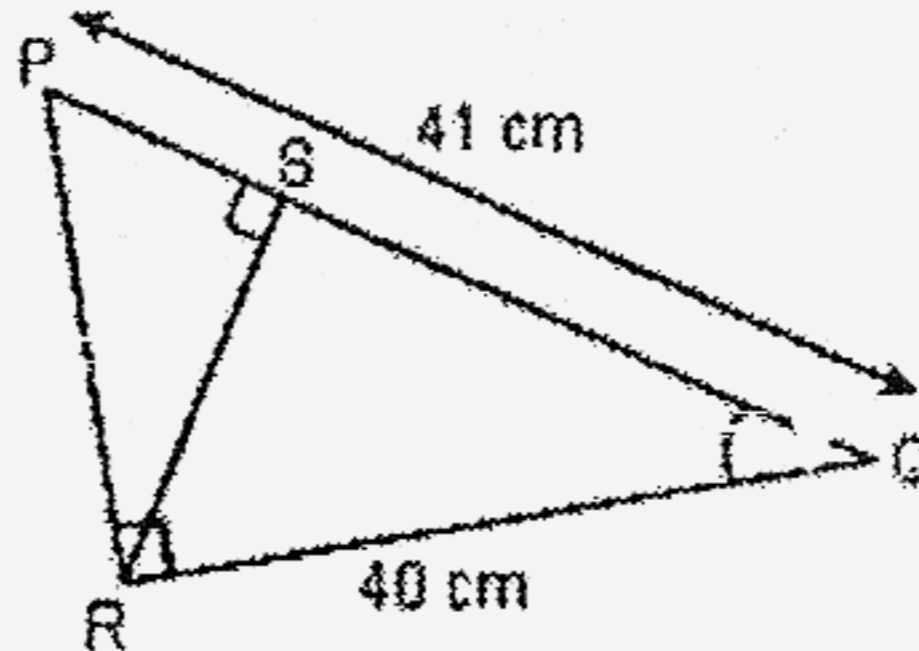
Calculate

(i) PR,   [1]

(ii) $\angle QRS$.   [2]


11. [Take $\pi = 3.142$, correct to 3 decimal places.]

[The volume of a cone of radius r and height h is $\dfrac{1}{3}$ r^2h.]

[The volume of a sphere of radius r is $\dfrac{4}{3}$ r^3.]

[The area of the curved surface of a cone of radius r and *slant height l* is rl.]

[The area of the curved surface of a sphere of radius r is 4 r^2.]

The diagram shows a container which consists of a cylinder with a cone attached to one end and a hemisphere attached to the other end.
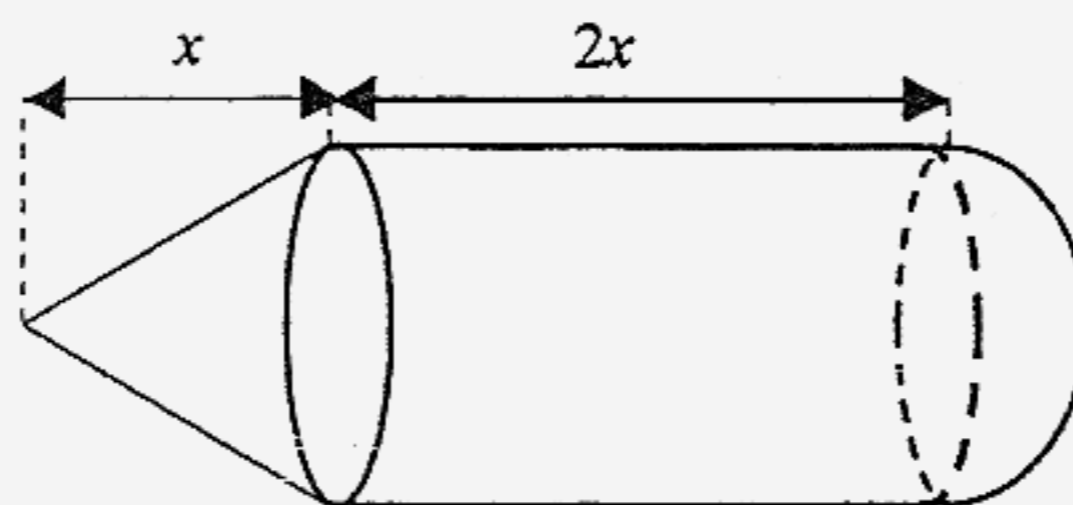
(a) Given that the height of the cone is x cm while the length of the cylinder is $2x$ cm, find

the ratio of $\dfrac{Volume\,of\,cone}{Volume\,of\,cylinder}$.   [2]

(b) If the volume of the cylinder is 485 cm^3 and its height is 12 cm, find the radius of the cylinder. [2]

(c) Using the radius found in (b), find the curved surface area of the cone. [2]

(d) The exterior of the container is to be painted with a coat of paint with a thickness of 0.3 mm. Find the volume of paint needed to paint such a container. [4]

***** END OF PAPER *****

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Fairfield Methodist Secondary School
Secondary 3 Express
End-of-Year Examination
Mathematics Answer Key

1 (a) 4.5
  (b) 0.60
  (c) 28.5005

2 (a) $\dfrac{9}{100}$
  (b) 0.0660675

3 (a) (i) 12
    (ii) -3
    (iii) -10
  (b) $x \le \dfrac{1}{2}$

4 (a) $4a[2-a]$
  (b) $(5y+2)(5y-2)$
  (c) $(2x+3y)(x+3z)$

5 (a) -19
  (b) 104

6(a) 3.2 cm
  (b) 0.9
  (c) 70.6

7. $\dfrac{5c^{18}}{2a^{8}b^{9}}$

8 (a) $w = \dfrac{u^{2}s - v^{2}}{1 - u^{2}}$
  (b) $1\dfrac{2}{3}$

9    $360

10    $x = 5, \ y = -3$

11 (a) 25 %
   (b) $4000

12 (a) $y = 3x - 3$

(b) $x = 1$

(c) Gradient of AC $\neq$ Gradient of BC,
     Therefore C is not collinear to B and
     C, hence Annette claim is wrong.

13 (a) 2,4..
      (all positive even integers, $n \ge 2$)
   (b) 3,5,..
      (all positive odd integers n , n >1)
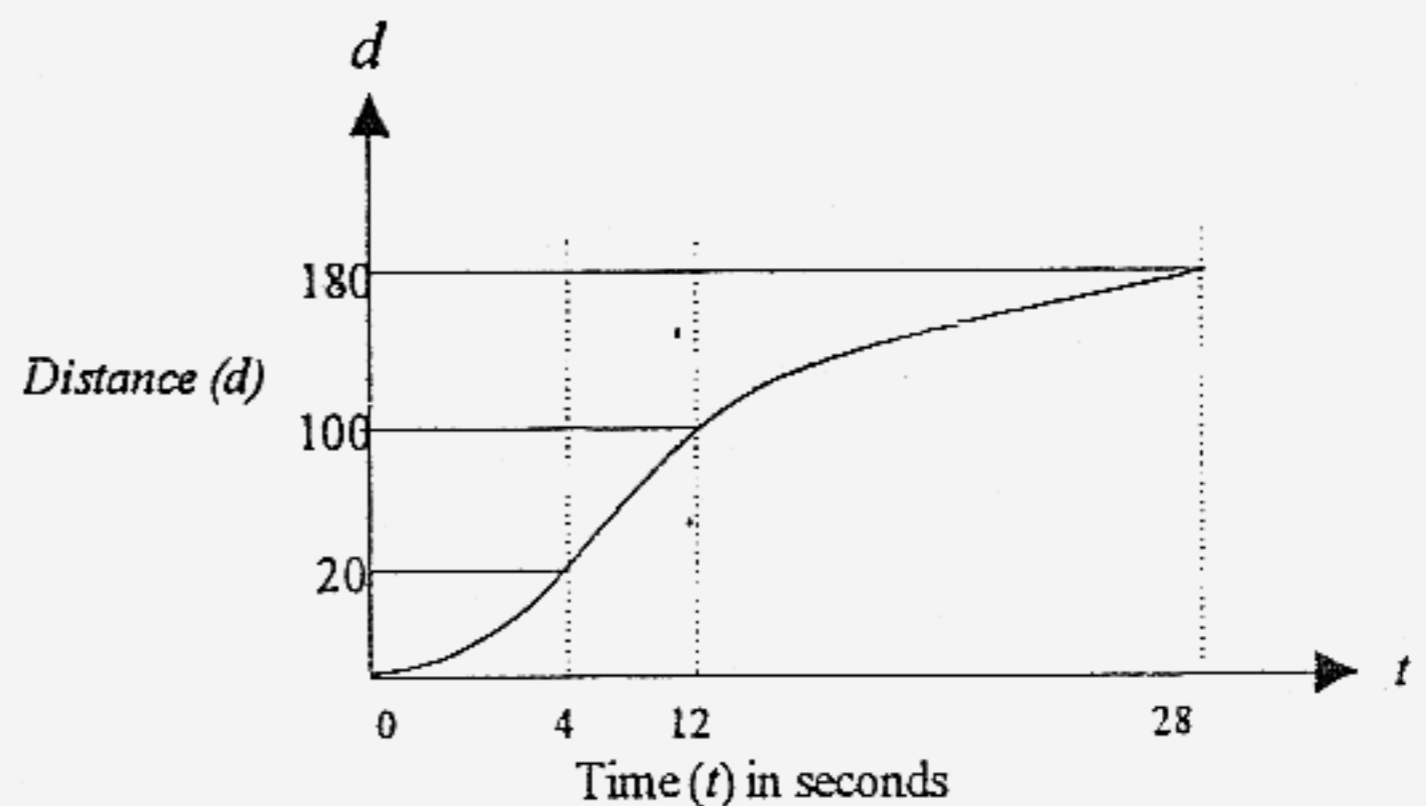   (c) -1, -3 ...
      (all negative odd integers, $n \le$ -1)

14 $\dfrac{11 + 3x}{(3 - x)(3 + x)}$

15 (a)

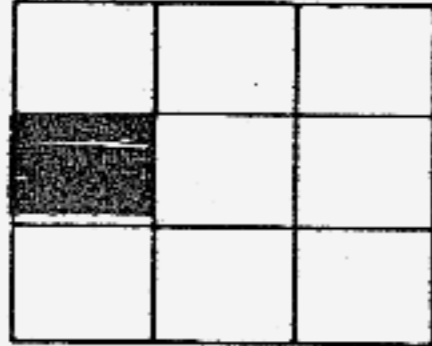| 4 | 0000 333333 5 7777 99 |
| 5 | 0 22 5555 |

(b) Sophia mentioned mode while
    Benedict mentioned median.

16 (a) 10
   (b) $-\dfrac{5}{8} m/s^{2}$
   (c) $4\dfrac{3}{8} m/s$
   (d)

www.misskoh.com
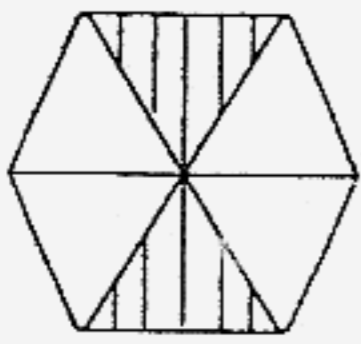
17 (a) 141°
   (b) 023°

18 (a)

  (b)

19 $x = -\dfrac{1}{3}$ or 4

20 (a) (i) 157.5°
     (ii) 16
     (iii) $\dfrac{3}{5}$

21 (a) 0
   (b) -1.5
   (c) $\dfrac{1}{7}$

22 (a) 1 : 40 000
   (b) 10 cm
   (c) 1.44 km^2

23 (a) 30.6π cm^2
   (b) $(10.8\pi + 8)$ cm

Fairfield Methodist Secondary School
Secondary Three Express End-Of-Year Examination
Mathematics Paper 2
Answer Keys

1a)   2.780

bi)   2830 kg or $2833\frac{1}{3}$ kg

bii)   35 : 9 : 4

ci) $m = 500t^2$

cii)   3.6 cm

ciii)   3125kg

2a)   Midpoint M is (1, 7), coordinates of S is (8, 14)

b) $y = -x + 8$

c)   PR = $6\sqrt{2}$ or 8.49 units
Area = 84.0 units^2

3a)   US$1887

b)   0.0908 l/km

c)   US$300 ≡ S$286.2. She had made a good buy.

di)   7.12%

dii)   S$1590

4a) $1320

b) $2838

c) $17412.50

5c)   08 42

6ai) $\dfrac{20}{x}$

aii) $\dfrac{25}{x-1}$

aiii) $\dfrac{20}{x+1}$

c)   4.18 or − 2.93

d)   4.78 days

7a)   603 m

b)   155.3°

c)   106 m

7di)   273 m

dii)   62.9 m

8a) $p = -2$

c)   gradient ≈ 2.09

d)   3.95

f) $1.4 < x < 5.73$

9a) $p = 45$

b) $25 \le x < 40$

c)   28.875 years

10ai) $S_3 = 36 (= 6^2)$
$S_4 = 100 (= 10^2)$

aii) $S_n = (\frac{1}{2}n(n+1))^2$

aiii) $k = 20$

10bi)   PR = 9 cm

bii)   77.3°

11a) $\dfrac{1}{6}$

b)   3.59 cm

c)   78.8 cm^2

d)   12.9 cm^3