Secondary 4 Normal (Academic)
Mid-Year Examination 2021

CANDIDATE NAME

CLASS

REGISTER NUMBER

MATHEMATICS SYLLABUS A

Paper 1

4045/01

4 May 2021

2 hours

Candidates answer on the Question paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
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.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 80.

The use of an approved scientific calculator is expected, where appropriate.
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 degree to one decimal place.
For π, use either your calculator value or 3.142.

This document consists of **17** printed pages and **3** blank pages.

[Turn over

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

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)**   Evaluate $\dfrac{\sqrt[3]{350 \times 5^{-2}}}{\pi - 2.4}$, giving your answers correct to 4 significant figures.

Answer .. .. [1]

(b)   Express 32.6% as a fraction.

Answer .... [1]

2   Given that $-8 < 3x + 4 \leq 9$, find all the integer values of x.

Answer . ... [2]

3   The line l has equation $3y - 2x + 9 = 0$.

(a)   Write down the gradient of the line l.

Answer .... [1]

(b)   Find the coordinates of the point where the line l crosses the y-axis.

Answer (. , .) [1]

[Turn over

4   Simplify $\dfrac{(2ab)^3}{35b} \div \dfrac{2a^3}{7b^4}$.

Give your answer as a single fraction in its simplest form.

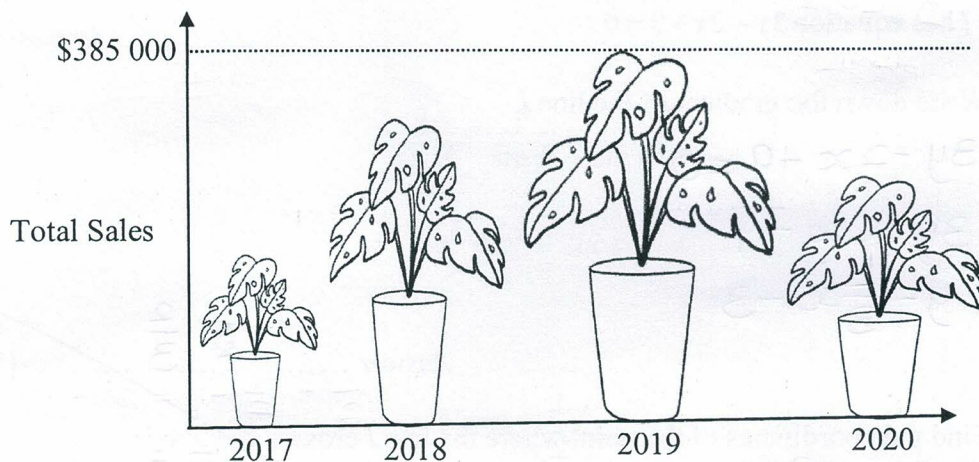*Answer* .... [2]

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5   A bag contains 48 balls, some of which are green, some are yellow and the rest are red.

The probabilities of drawing a red ball and a yellow ball are $\dfrac{5}{16}$ and $\dfrac{1}{6}$ respectively.

Find the number of green balls.

Answer .... [2]

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6   The bar graph shows the total sale of plants by Far East Nursery from 2017 to 2020.
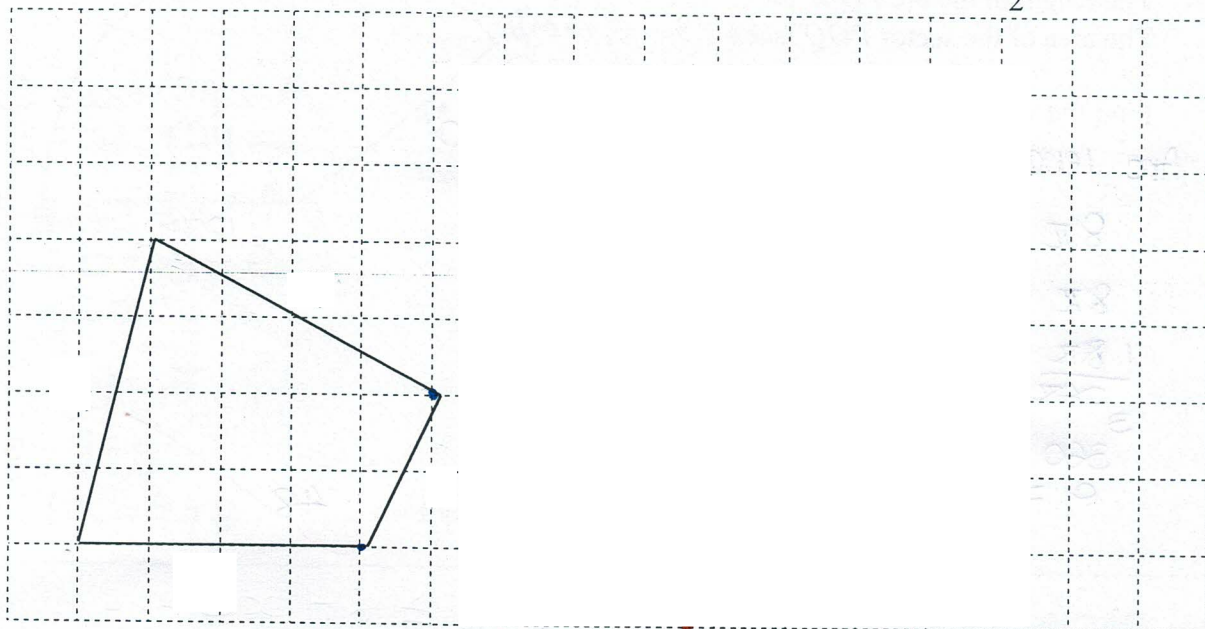

State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.
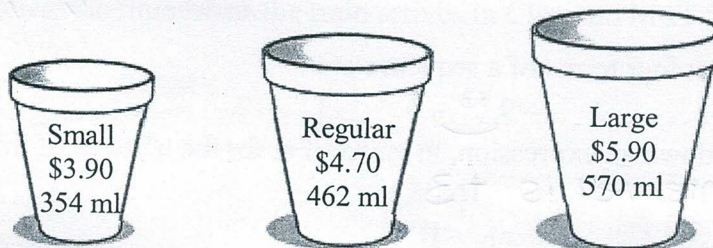
Answer

[2]

7   On the grid, draw an enlargement of the figure using a scale factor of $\frac{3}{2}$.

[2]

___

8   While Adele waits for her friend, she buys a cup of hot chocolate.

Small
$3.90
354 ml

Regular
$4.70
462 ml

Large
$5.90
570 ml

Find which of the three sizes gives the best value.
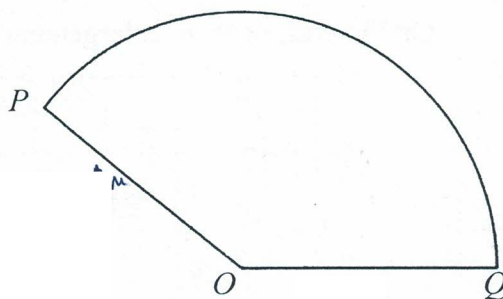**You must show all your working.**

Answer

[2]

___

[Turn over

9 PQ is an arc of a circle, center O, radius 12 cm.
The length of the arc PQ is 8π.
The area of the sector POQ is $k\pi$.

Find the value of k.

Answer k = ..   . [3]

---

10   **(a)**   The nth term of a sequence is given by $3n^3 - 5n$.
Write down the first three terms of this sequence.

Answer ..   .. [2]

   (b)   The first four terms of a sequence are
$$-9, \quad -6, \quad -3, \quad 0.$$
Write down an expression, in terms of n, for the nth term of this sequence.

Answer ..   .. [1]

---

11   Thomas and Chris share a sum of money in the ratio of $4 : 5$.
Thomas saves $\dfrac{1}{2}$ of his share, gave $\dfrac{1}{6}$ of the remaining money to his sister and spends
the rest.
If Thomas spends \$52, calculate the amount of money Chris gets.

Answer \$ .... [3]

12   Solve these simultaneous equations.

$$6x + 3y = 4$$
$$2y - 2x = 1$$

Answer x =   *and y =*   [3]

13   The train leaves Toa Payoh MRT Station at 13 56 and takes 18 minutes to reach Clementi MRT Station.

(a)   Calculate the time when the train arrives in Clementi MRT Station.

Answer ..   .. [1]

(b)   The distance between Toa Payoh MRT Station to Clementi MRT Station is 10.2 km.
Calculate the average speed of the train in kilometres per hour.

Answer .... km/h [2]

[Turn over

14 **(a)** When written as the product of their prime factors,

$$a = 2^2 \times 3^4$$
$$b = 2^2 \times 3^3 \times 7$$
$$c = 2 \times 3^5 \times 5^2$$

Find

(i) the LCM of a, b and c, giving your answers as the product of its prime factors,

Answer .... [1]

(ii) the greatest number that will divide a, b and c exactly.

Answer .... [1]

(b) Written as a product of its prime factors, $4320 = 2^5 \times 3^3 \times 5$.

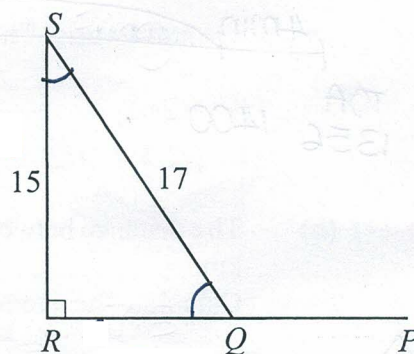Find the smallest positive integer p such that $\dfrac{4320}{p}$ is a cube number.

Answer p = ... [1]

---

15 In the diagram, QRS is a right-angle triangle.

Line PQR is a straight line and $\sin \angle RQS = \dfrac{15}{17}$.

Express each of the following as a fraction.

(a) $\tan \angle RQS$,

Answer .... [1]

(b) $\sin \angle QSR$,

Answer .... [1]

(c) $\cos \angle PQS$.

Answer .... [1]

16   Ashley bought a pair of sports shoes at HK\$ 892.50 after a 15% discount during her holiday in Hong Kong. The exchange rate between the Singapore dollar (S\$) and the Hong Kong dollar (HK\$) is S\$ 1 = HK\$ 5.78.

(a)   Calculate the original selling price of the shoes in Hong Kong dollars.
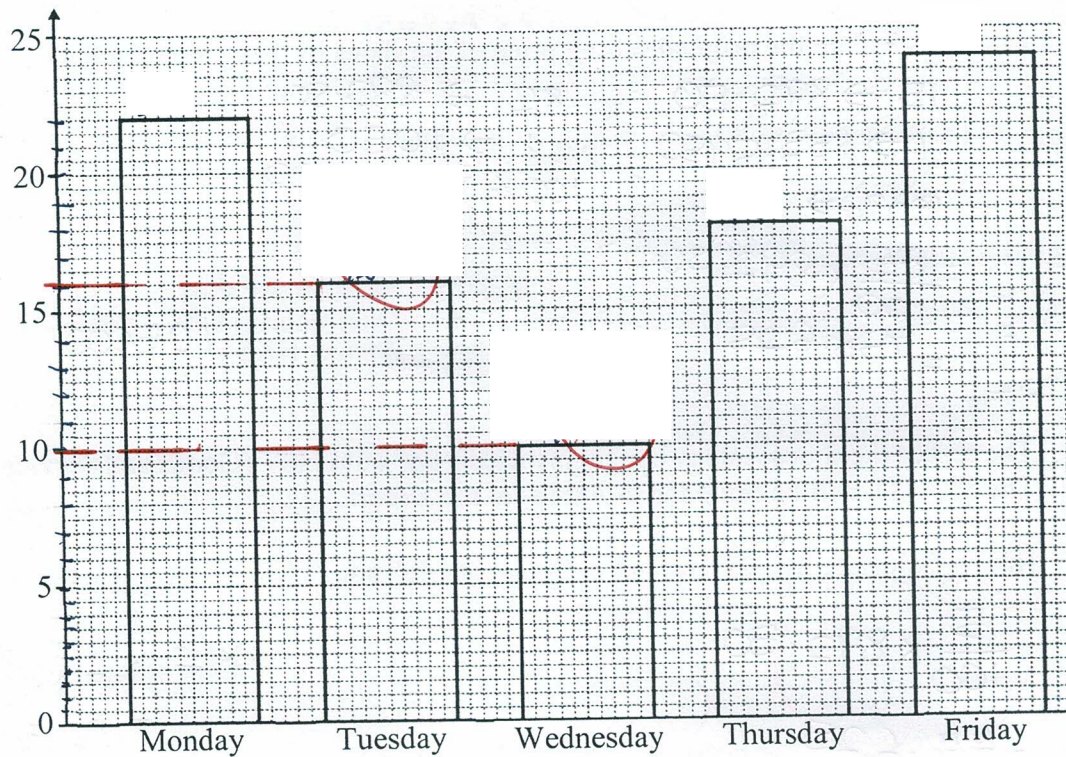
Answer HK\$. ……. [1]

The cost of the shoes Ashley bought is inclusive of a 5% GST (Goods and Service Tax). The 5% GST will be refunded to Ashley at the airport.

(b)   Calculate the GST refund in Singapore dollars.

Answer S\$. ……...... [2]

[Turn over

17   Mrs Tan records the number of students who are late for school each day.
      The results for one week are shown in the bar chart.

(a)   State the day with the most number of students who are late for school.

                                        Answer ..   .... [1]

(b)   How many more students were late on Friday than on Tuesday?

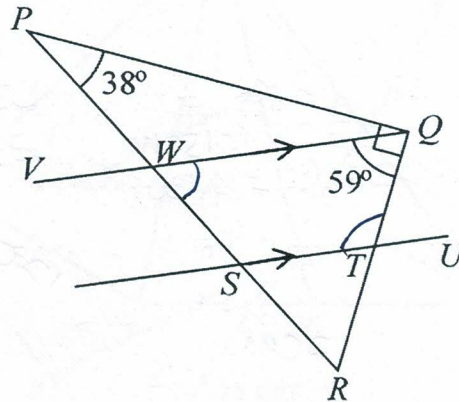   Answer .... [1]

Mrs Tan decides to draw a pie chart to show this information.

(c)   Calculate the angle of the sector representing the number of students who are
       late for school on Thursday.

                                        Answer ....   .. [2]

18 In the diagram, *PQR* is a right-angled triangle, *STU* is parallel to *VWQ*, $\angle PQR = 90°$ and $\angle WQR = 59°$.

(a) Find $\angle QTU$, giving a reason for your answer.

$\angle QTU$ = ... because . . . .

. . . . [2]

(b) Calculate $\angle PWV$.

Answer . . . . [2]

19 $$x^2 + 8x - 3 = (x+a)^2 + b$$

(a) Find *a* and *b*.

Answer a = ... *b* = ... [2]

(b) Hence solve $x^2 + 8x - 3 = 0$, giving your answers correct to 2 decimal places.

Answer x = ... or . . . . [2]

20
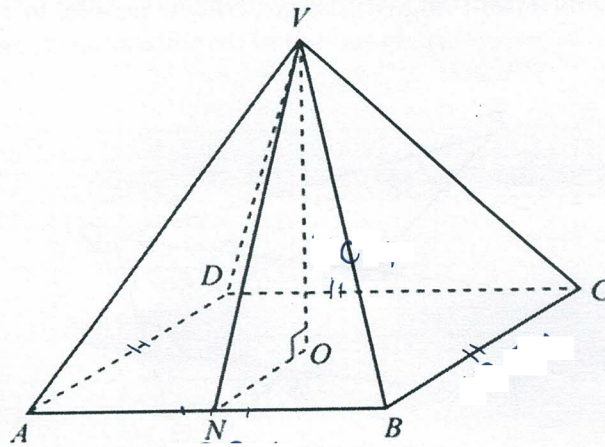
The diagram shows a solid candle in the shape of a square-based pyramid *VABCD*.
O is the centre of the base *ABCD* and *VO* is perpendicular to the base.
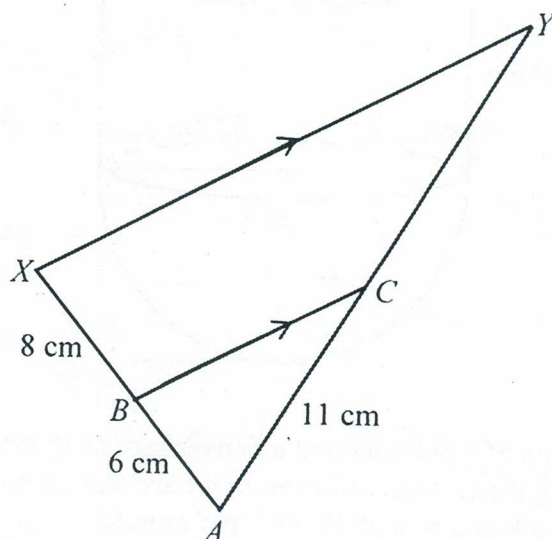*N* is the mid-point of *AB*.
AB = 12 cm and *VO* = 15 cm.

(a) Calculate the volume of the candle.

Answer ....cm³ [2]

(b) Calculate the total surface area of the candle.

Answer ... .cm² [2]

21   In the diagram below, triangle ABC is a reduction of triangle AXY.
      $AB = 6$ cm, $BX = 8$ cm, $AC = 11$ cm and BC is parallel to XY.

(a)   Write down the scale factor for the reduction.

                                        Answer .... [1]
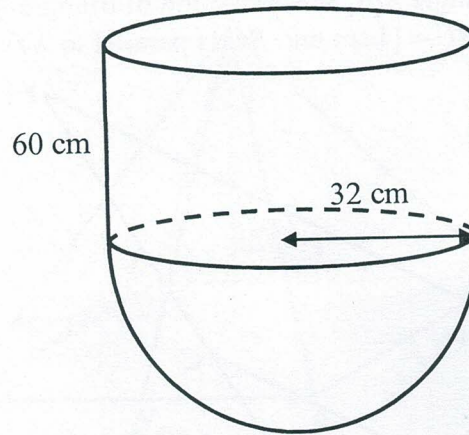
(b)   Calculate the length of CY.

                                        Answer .... cm [1]

(c)   Given that the area of triangle AXY is 25.8 cm², find the area of triangle ABC.

                                        Answer ....cm² [2]

[Turn over

22

60 cm

32 cm

A water tank is made up of a cylinder and a hemisphere as shown above.
The cylinder has a height of 60 cm and a circular base with radius 32 cm.
Water flows into the tank at a rate of 25 litres per minute.

Calculate the time it takes to fill the tank from empty.
Give your answer in minutes and seconds.

Answer . . . . minutes . . . . . seconds [4]

23 **(a)** Simplify $4a - 2 - (3 - 2a)$.

Answer ... ... [1]

(b) Simplify $\dfrac{4x}{3} - \dfrac{x+2}{5}$.
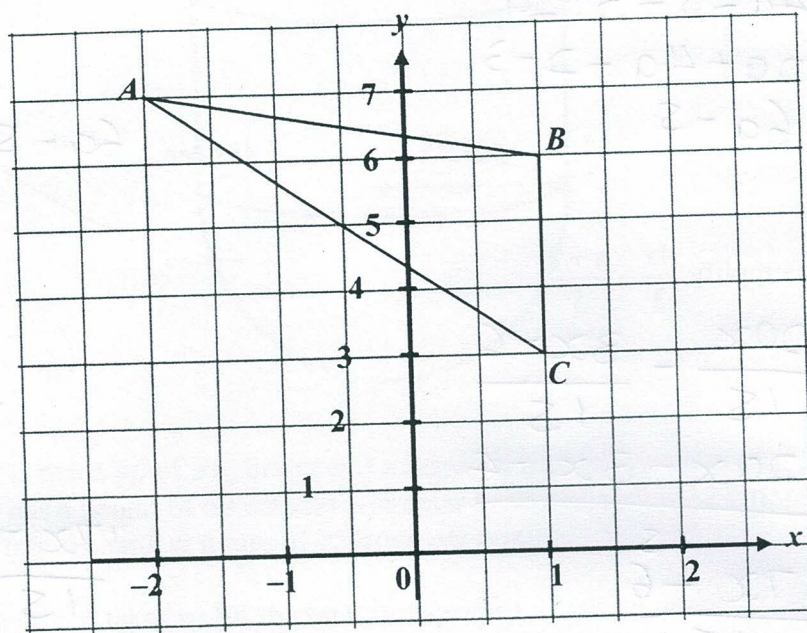
Answer .... . [2]

(c) Factorise completely $3a^2 + 2b^2 - 3a - 2ab^2$.

Answer . [2]

24   The points A (-2, 7), B (1, 6) and C (1, 3) are shown on the diagram.

Find

(a)   the equation of the line BC,

Answer .... [1]

(b)   the length of AC,

Answer .... [1]

(c)   the equation of the line AB,

Answer .... [2]

(d)   the area of the triangle ABC.

Answer .... [1]

25 In the diagram, all lengths are in centimetres.

$$3x + 2$$

$$x + 5$$

$$3x$$

$$2x + 1$$
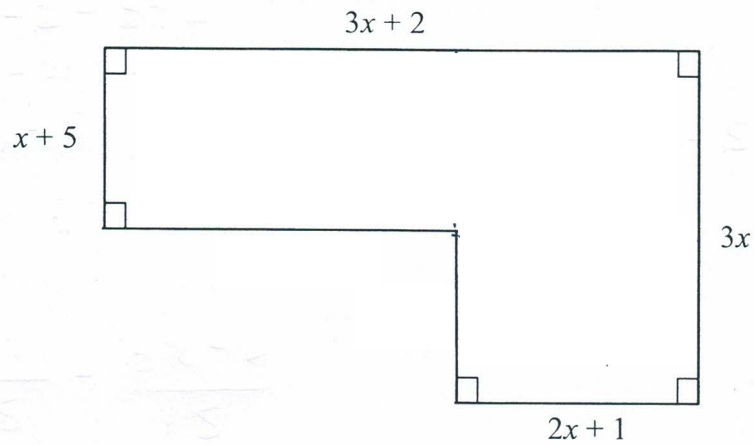
(a) Show that the area of the shape can be reduced to $7x^2 + 9x + 5$.

Answer .... [3]

(b) The area of the shape is 96 cm.
Form an equation and solve for x.

Answer $x = $ . . [3]

CANDIDATE
NAME

CLASS 4/

REGISTER
NUMBER

MATHEMATICS SYLLABUS A

4045/02

Paper 2

5 May 2021

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, and glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer **one** question.

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

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total number of marks for this paper is 60.

The use of an approved scientific calculator is expected, where appropriate.
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 degree to one decimal place.
For π, use either your calculator value or 3.142.

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Section A (52 marks)

Answer **all** the questions in this section.

1   (a)   Work out $\sqrt{38} \times \dfrac{0.043}{18.1 - 3.76}$.

Answer … … [1]

(b) y is inversely proportional to the square of x.

Given that $y = \dfrac{1}{2}$ when $x = 2$, find the values of x when $y = 8$.

Answer x = … [2]

2   Yvette owns a dress shop.
She records the number of dresses of each size that she sells over a period of 30 days.
The results are shown in the table.

Size of dresses	34	36	38	40	42
Frequency	3	3	14	6	4

(a)   Estimate the mean.

Answer ....   .. [2]

(b)   Yvette wants to use the data to help her decide which size she should keep more stock of. Stating the statistic used, explain how Yvette will make her decision.

Answer_

[2]

3   Simplify
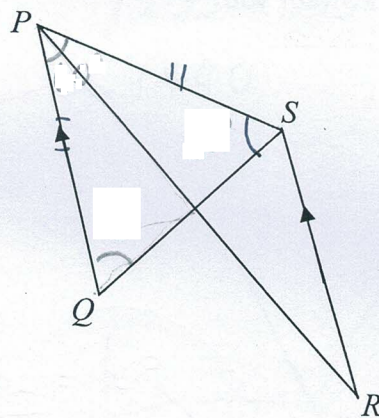
(a) $\dfrac{ab^4 \times a^2 b^8}{(ab)^2}$

Answer ...   . [2]

(b) $\left(\dfrac{x^3}{27}\right)^{\frac{2}{3}}$.

Answer ...   . [2]

4   (a)   Three interior angles of a hexagon are 96° each.
The remaining three interior angles are each $x°$.
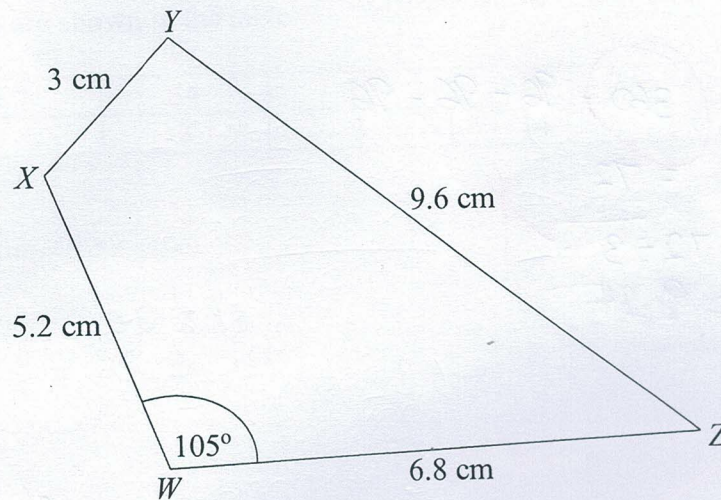Find x.

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

(b)

In the diagram, PQ is parallel to SR and $PQ = PS$.
Show that angle PSQ = angle QSR.
Answer

[2]

5   The diagram shows a sketch of a quadrilateral *WXYZ*.

Y

3 cm

X

9.6 cm

5.2 cm

105°

W   6.8 cm   Z

(a)   Construct the quadrilateral *WXYZ* accurately.
The side *WZ* has been drawn for you.

Z   [2]

W

(b)   The angle bisector of angle *XWZ* meets *YZ* at *P*.
Construct the angle bisector of angle *XWZ* and measure *PZ*.

Answer PZ = ... cm [2]

6   The price of a bicycle in a shop is $1 200.
      At a sale, the shopkeeper reduces the price to $1 080.

      (a)   Calculate the reduction as a percentage of the sale price.

                                          Answer   ....% [2]

      (b)   The tag price of $1 200 is 40% more than the amount the shopkeeper paid for
      the bicycle.
      Calculate the actual profit that the shopkeeper made.

                                          Answer $.....   .. [3]

[Turn over

7   (a)   Agatha has $2 000 to invest for 5 years.
            Bank A offers 5% simple interest per annum.
            Bank B offers 4.5% interest, compounded yearly.

            Which bank should she choose?

                                        Answer .... [3]

     (b)

            ┌─────────────────────────────┐
            │ *Brom Bicycle*   │
            │ Cash price $5 600   │
            │ 20% deposit   │
            │ 12 monthly instalments   │
            │ 5% simple interest   │
            └─────────────────────────────┘

            Bill wants to buy a bicycle on hire purchase.
            Calculate the total amount that Bill paid for the bicycle.

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

8 **(a)** Expand and simplify $2x(3x-4y)-(y-x)^2$.

Answer ... [2]

(b) Factorise completely $16-4x^2$.

Answer [2]

(c) Rearrange this formula to make x the subject.

$$A = \frac{px^3 - 3}{2}$$

Answer $x = $ .... [3]

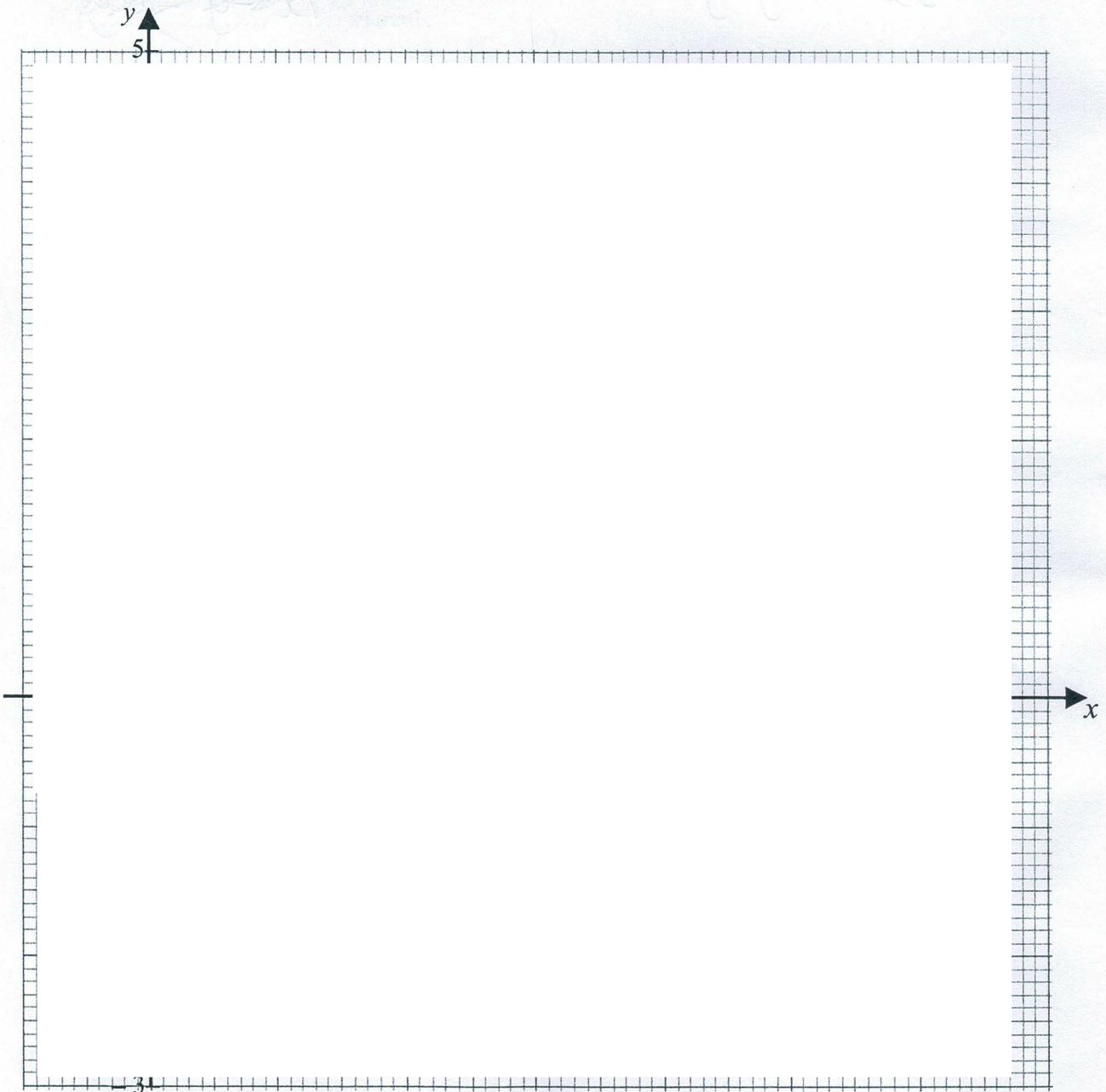9   The table of values below is for $y = x - 6 + \dfrac{3}{x}$.

x	0.2	0.5	1	1.5	2	3	4	5	6
y	4.2	0.5	-2	-2.5	-2.5	-2	-1.25	-0.4	0.5

(a)   On the grid draw the graph of $y = x - 6 + \dfrac{3}{x}$.

Use a scale of 2 cm to 1 unit on the horizontal x-axis for $0 \le x \le 6$.

Use a scale of 2 cm to 1 unit on the vertical y-axis $-3 \le x \le 5$.   [3]

(b)   On the same grid, draw the graph of $y = 3 - 2x$.

[2]

(c)   Use your graph to find the coordinates of the points of intersection.

Answer (   ) and (   ) [2]

10   A moving company "Move It lah!' offers the following vehicles for hire.
      The table shows the charges for the service provided.

Vehicle	2.4m Van	3m lorry	4.2m Lorry
Base Fare	$38	$42	$79
Distance Charge per km	$0.50	$0.75	$0.75
Additional Stop charge	$11	$11	$17
Weight limit	500 kg	900 kg	1 800 kg
Size (L x W x H) cm	230 x 120 x 120	290 x 140 x 170	420 x 170 x 190
Service included	Free Driver's help	--	--
Additional Service (chargeable)	Additional helper $30	Driver's help $30 Additional helper $40	Driver's help $30 Additional helper $40
Overtime fees	$5 per 10-minute block per helper	$5 per 10-minute block per driver/helper	$5 per 10-minute block per driver/helper
Packing Box (50 x 40 x 40 cm)	$5 for a pack of 10	$5 for a pack of 10	$5 for a pack of 10
Items that can fit in vehicle		Queen-sized mattress Household Appliances and Furniture not higher than 1.6 m	King-sized mattress Household Appliances and Furniture not higher than 1.8 m

(a)   Find the number of <u>packing boxes</u> that can fit into a van.

Answer ....boxes [2]

[Turn over

(b)   Jenny wants to shift all her work files and materials to her new office.
She has 40 of her own boxes, each of which are (40 x 40 x 40) cm in size.
Which vehicle should she hire to shift her items?
Show your working clearly.

Answer ....[2]

Impressed by the service of the company during the move to her new office, Jenny decides to engage the same company when she wants to move house.

Her new address is 40 km away from her present house.
She needs to buy at most 42 boxes to pack all the things in her house.
The items that need to be moved include a queen-sized mattress, wardrobes of height 1.8 m, a refrigerator and a 3-seater sofa which is to be dropped off at a children's home on the way to her new house.
Jenny estimates that all the items, excluding the boxes would require a floor area of about 40 000 cm^2.

Jenny decides to hire the driver and helper to help carry the items.

(c)   Calculate the total price that Jenny would have to pay.

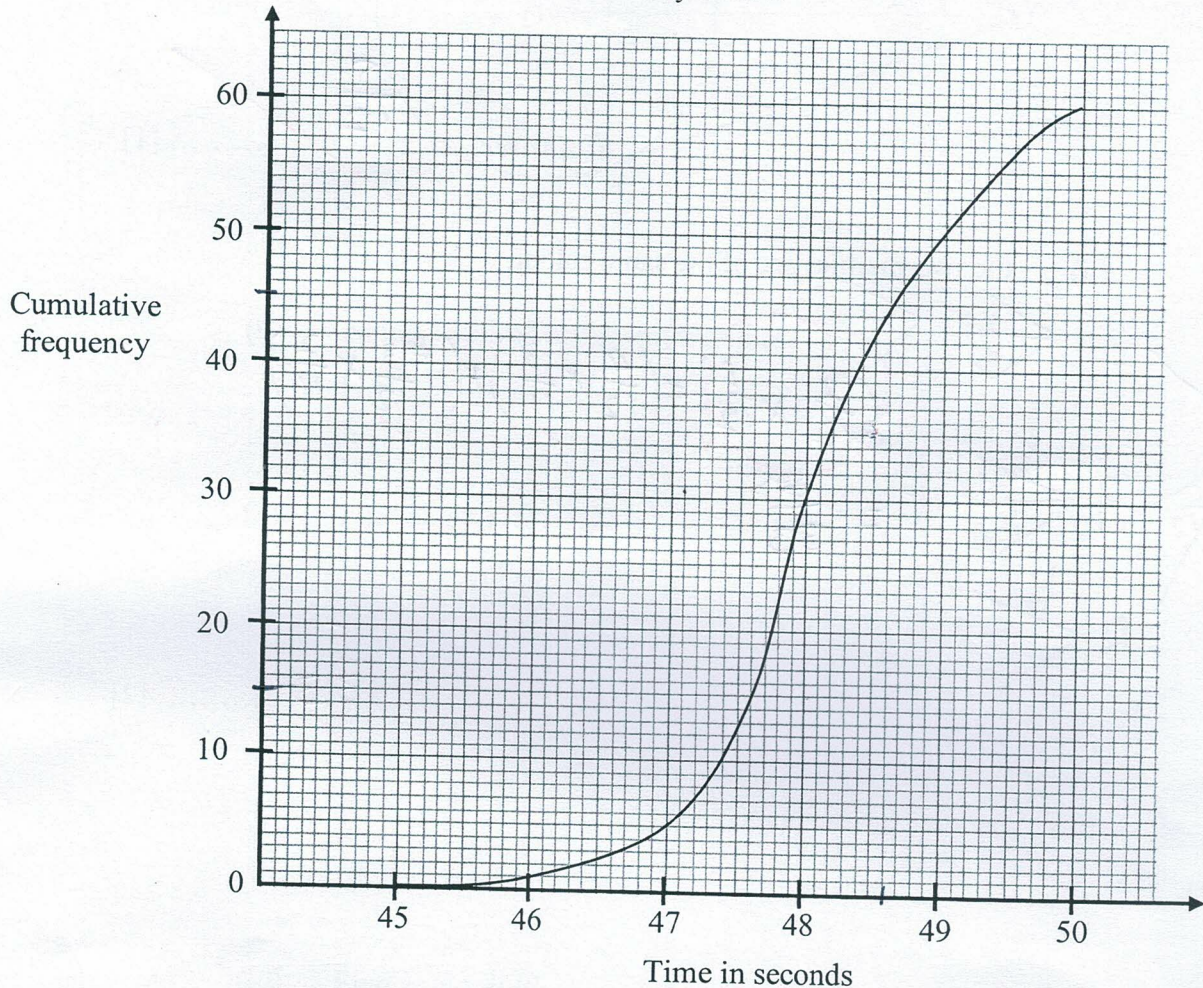*Answer* $...... ..[5]

Section B (8 marks)

Answer one question from this section. Each question carries 8 marks.

11   **(a)**   The cumulative frequency shows the distribution of timings achieved by 60 female swimmers in a 50 m freestyle race.

Use the graph to estimate

(i)   the median,

Answer ……………………. seconds [1]

(ii)   the interquartile range,

Answer …………………. seconds [2]

One student broke the school's record for 50 m freestyle race.

(iii)   What is the new school record?

Answer …………… seconds [1]

[Turn over

(b)   A bag contains 3 blue marbles, 5 green marbles and 4 red marbles.
Chin takes a marble at random from the bag and places it on the table.
She then takes a second marble at random from the bag.
Calculate the probability that
(i)   the first marble is green,

Answer .... [1]

(ii)   the two marbles are of the same colour,

Answer .... [2]

(iii)   neither marble is red.

Answer .... [1]

Question 12 is printed on the next page

12 **(a)**
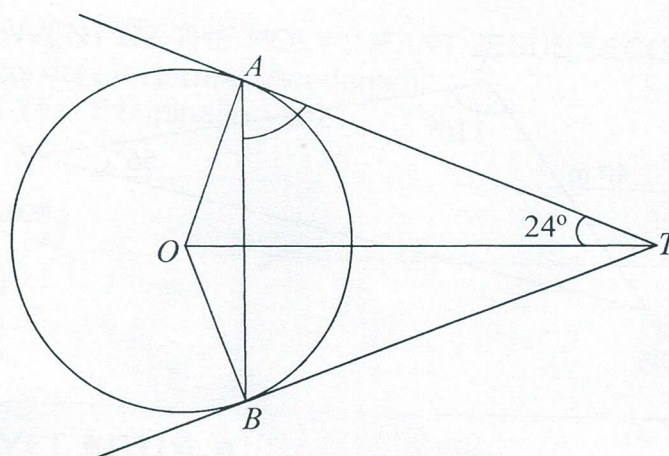
(i) Name a pair of congruent triangles.

Answer Δ …………≡ Δ ……..…… [1]

(ii) Find angle *TAB*.

Answer …………………..…… [1]

(iii) Find angle *AOB*.

Answer …………………..…… [2]

(b)
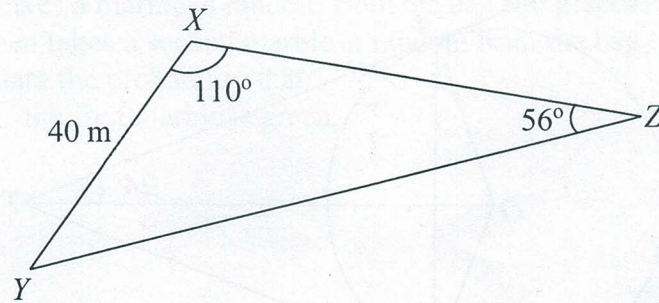
The diagram shows a triangular field, *XYZ*, on horizontal ground.

XY = 40 m, angle *YXZ* = 110° and angle *XZY* = 56°.
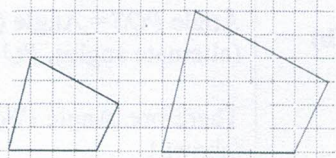
(i)   Calculate the length of *XZ*.

Answer ....m [2]

(ii)   A jet flies over the field and is 6 m above point *X*.
Calculate the angle of depression of *Z* from the jet.

Answer .... [2]

Paper 1			
1(a)	3.250	1(b)	163/500
2	-3, -2, -1, 0, 1,	3(a)	2/3
3(b)	(0, -3)	4	$4b^2/5$
5	25	6	In a bar chart, only the height of the diagram should change. The size may exaggerate the difference in sales, making it seem more than it actually is.
7		8	The regular size gives the best value.
9	$k = 48$	10(a)	-2, 14, 66
10(b)	$3n - 12$	11	$156
12	$x = 5/18$ and $y = 7/9$	13(a)	14 14
13(b)	34 km/h	14(a)(i)	2^2 x 3^5 x 5^2 x 7
14(a)(ii)	54	14(b)	$p = 20$
15(a)	15/8	15(b)	8/17
15(c)	-8/17	16(a)	HK $ 1050
16(b)	S$7.35	17(a)	Friday
17(b)	8	17(c)	72°
18(a)	Angle $QTU = 59°$ because alternate angles are equal, STU is parallel to VWQ.	18(b)	69°
19(a)	$a = 4$ and $b = -19$	19(b)	$x = 0.36$ or $x = -8.36$
20(a)	720 cm³	20(b)	532 cm²
21(a)	3/7	21(b)	14 2/3
21(c)	4.74 cm²	22	10 minutes and 28 seconds or 10 minutes and 27.9 secondas
23(a)	6a -5	23(b)	(17x -6)/15
23(c)	$(a - 1)(3a - 2b^2)$	24(a)	$x = 1$
24(b)	5 units	24(c)	$y = -1/3 x + 6 1/3$
24(d)	45 units²	25(b)	$x = 3.02$ cm

Paper 2				
1(a)	0.0185	**1(b)**	$x = \pm 0.5$	
2(a)	38.3	**2(b)**	Yvette should use the Mode as it indicates that size 38 is the most popular size.	
3(a)	ab^{10}	**3(b)**	$x^2/9$	
4(a)	$x = 144$	**4(b)**	Angle PQS = Angle PSQ (base angles of isosceles triangle) Angle PQS = Angle QSR (alternate angles, PQ // SR) Therefore, Angle PSQ = Angle QSR (shown)	
5(a)		**5(b)**	PZ = 5.5 cm or 5.6 cm	
6(a)	11 1/9 %	**6(b)**	$222.86	
7(a)	Bank A	**7(b)**	$5824	
8(a)	$5x^2 - 6xy - y^2$	**8(b)**	$4(2 + x)(2 - x)$	
8(c)	$\sqrt[3]{\dfrac{2A+3}{p}}$	**9**		
9(c)	(0.3, 2.4) and (2.6, -2.25)	**10(a)**	36 boxes	
10(b)	Van	**10(c)**	$221	
11(a)(i)	48 seconds	**11(a)(ii)**	1.05 seconds or 1 seconds	
11(a)(iii)	46 seconds	**11(b)(i)**	5/12	
11(b)(ii)	19/66	**11(b)(iii)**	14/33	
12(a)(i)	Triangle OAT congruent to Triangle OBT	**12(a)(ii)**	66°	
12(a)(iii)	132°	**12(b)(i)**	11.7 m	
12(b)(ii)	27.2°			