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YUYING SECONDARY SCHOOL
END-OF-YEAR EXAMINATION
 Secondary 2

NAME

CLASS

REG. NO

G3 MATHEMATICS
4052

Section A

2 October 2024

2 hours 15 mins

Candidates answer on the question paper.

READ THESE INSTRUCTIONS FIRST
This paper consists of Section A and Section B.

Write your name, class and register number.

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** the 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 in the space below the question.

Omission of essential working will result in loss of marks.

The number of marks for Section A and Section B is 45 each.

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 degrees to one decimal place.

For π , use either your calculator value of 3.142.

For Examiner's Use	
Section A	45

[Turn over

1 Solve

(a) $2(x-5) + 3(2x+1) = 9,$

Answer $x = \dots\dots\dots$ [2]

(b) $\frac{y}{3} + 2y \geq \frac{2}{5}.$

Answer $\dots\dots\dots$ [2]

- 2 A sum of money is divided among John, Ali and Belle.
 The ratio of John's share to Ali's share is 5 : 7.
 The ratio of Ali's share to Belle's share is 13 : 10.

- (a) Find the ratio of the money shared between John : Ali : Belle.

Answer : : [2]

- (b) If the difference between the largest and smallest shares is \$910, how much is John's share?

Answer \$ [2]

- 4 Express each of the following as a single fraction in its simplest form.

(a) $\frac{4}{x+1} + \frac{3}{x-2},$

Answer [2]

(b) $\frac{3}{y^2-25} - \frac{2}{y+5}.$

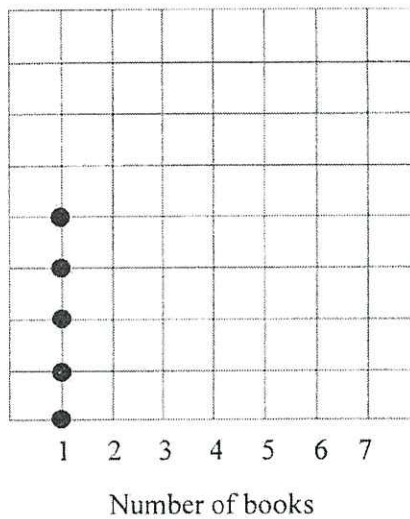
Answer [3]

- 5 The number of books borrowed by 20 students in the month of April is as given below.

3	2	4	1	2
2	7	2	1	3
1	1	4	5	2
2	2	1	5	2

- (a) Complete the dot diagram to represent the information given above. [1]

Answer



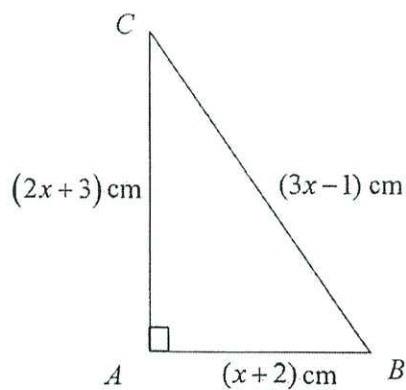
- (b) Find
(i) the mode,

Answer [1]

- (ii) the mean.

Answer [2]

- 6 The diagram below shows a right-angled triangle ABC where $AB = (x + 2)$ cm, $BC = (3x - 1)$ cm and $AC = (2x + 3)$ cm.



- (a) Using Pythagoras' theorem, form an equation in x and show that it reduces to $2x^2 - 11x - 6 = 0$.

Answer

[3]

- (b) Hence, solve the equation $2x^2 - 11x - 6 = 0$.

Answer $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

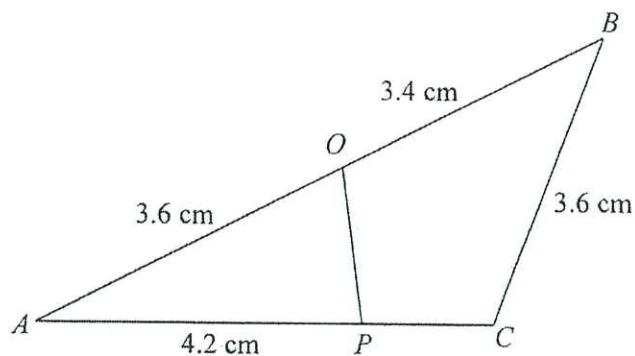
- 7 Solve the following simultaneous equations.

$$2x = 1 - y$$

$$4x + 5y = 8$$

Answer $x = \dots\dots\dots$, $y = \dots\dots\dots$ [4]

- 8 In the figure below (not drawn to scale), $\triangle APO$ is similar to $\triangle ABC$, where $AP = 4.2$ cm, $AO = 3.6$ cm, $BO = 3.4$ cm and $BC = 3.6$ cm.



Find the length of

- (a) PO ,

Answer cm [2]

- (b) PC .

Answer cm [2]

- 9 It is given that y is inversely proportional to $(x^2 + 2)$ and $y = 5$ when $x = 4$.

Find

- (a) an equation connecting x and y ,

Answer [2]

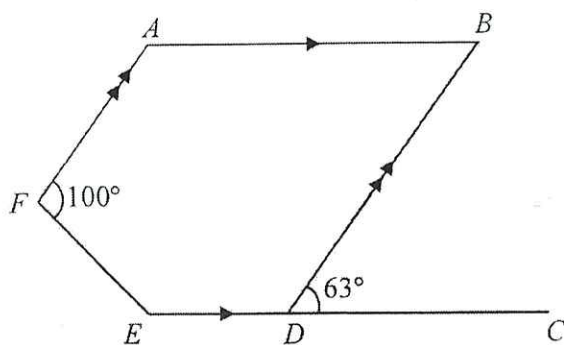
- (b) the value of y when $x = \frac{1}{2}$.

Answer $y =$ [2]

10 Simplify $\frac{2x^2 - xy}{x} \div \frac{6x^2 - 7xy + 2y^2}{6x - 4y}$.

Answer [4]

- 11 In the diagram below, AB is parallel to EDC and AF is parallel to BD .
 $\angle BDC = 63^\circ$ and $\angle AFE = 100^\circ$.



- (a) State the reason why

(i) $\angle ABD = \angle BDC = 63^\circ$

Answer [1]

(ii) $\angle ABD + \angle FAB = 180^\circ$

Answer [1]

- (b) Find $\angle FED$

Answer $^\circ$ [1]

End of Section A



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Candidates answer on the question paper.

Section B

For Examiner's Use

Qn No	12	13	14	15	16	17	18
Marks							

For Examiner's Use

Section B	45
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- 12 (a) (i) Simplify $a^2 - (a + c)(a - c)$.

Answer [2]

- (ii) Hence, write down the value of $999^2 - 1004 \times 994$.

Answer [2]

- (b) If $2(x - y)^2 = 128$ and $xy = 20$, find the value of $5(x^2 + y^2)$.

Answer [3]

- 13 The distance, d , travelled by a soccer ball when dropped from a building is directly proportional to the **square** of the time taken, t , for the ball to drop to the ground.

t (s)	1.4	1.8	2.1	2.3
d (metres)	9.8	16.2	22.05	26.45

Given the values above,

- (a) show that d and t are in direct proportion,

Answer [2]

- (b) find the distance travelled by the soccer ball when it takes 3.3 seconds for it to hit the ground,

Answerm [2]

- (c) find the percentage increase in d if t is doubled.

Answer% [3]

- 14 An object was thrown vertically upwards from the top of a building. Its height, y metres, above the ground x seconds after it is released can be represented by the equation $y = 28 + 48x - 12x^2$.

Some corresponding values of x and y are given in the table below.

x	0	1	1.5	2	2.5	3	4	4.5
y	28	64	73	76	73	p	28	1

- (a) Calculate the value of p .

Answer $p = \dots\dots\dots$ [1]

- (b) Draw the graph of $y = 28 + 48x - 12x^2$ for $0 \leq t \leq 5$ on the grid provided on the next page. [3]

- (c) From your graph, find

- (i) the greatest height reached by the object from the ground,

Answer $\dots\dots\dots$ m [1]

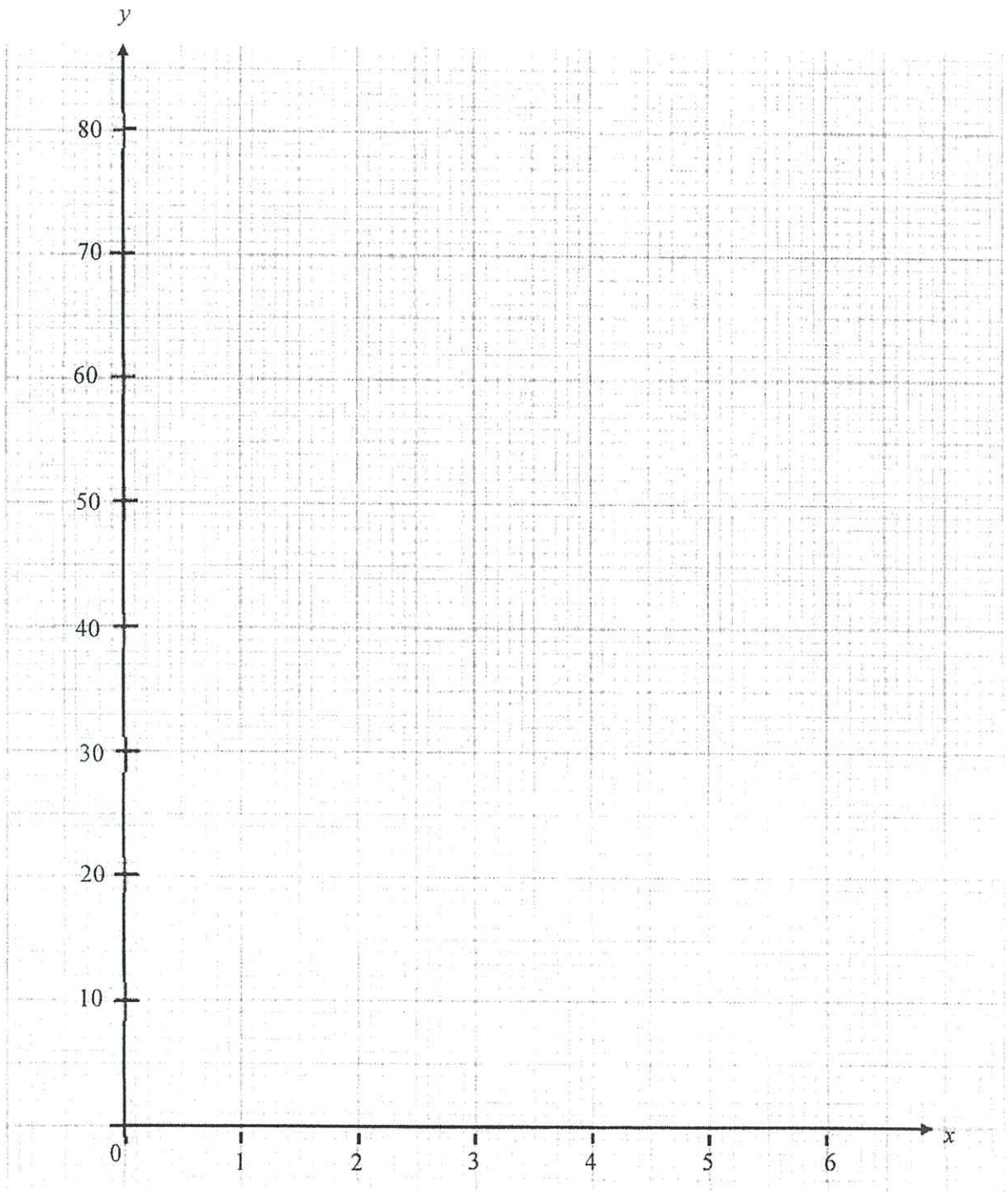
- (ii) the time taken for the object to hit the ground,

Answer $\dots\dots\dots$ s [1]

- (iii) the length of time when the object was more than 60 m above the ground.

Answer $\dots\dots\dots$ s [1]

Answer (b)



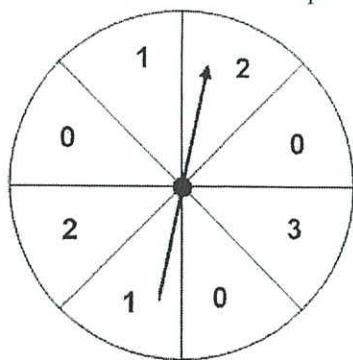
- 15 In a shopping mall, the proposed actual area of a bookstore is 0.0045 km^2 . The bookstore is 5 cm^2 on the floor plan.
- (a) Given that the floor plan is drawn on a scale of $1 \text{ cm} : n \text{ km}$, find the value of n .

Answer $n = \dots\dots\dots$ [2]

- (b) Calculate the actual distance, in metres, between the bookstore and the nearest eatery, which is 0.8 cm apart on the floor plan.

Answer $\dots\dots\dots \text{ m}$ [2]

- 16 In a newly opened boutique, a lucky draw wheel with 8 sectors is featured. Customers are allowed to spin the wheel once for every purchase.



Pointer landing on	Lucky draw prize
0	No prize
1	Soft toy
2	\$20 shopping voucher
3	Grand prize: A bag worth \$80

- (a) Find the values of a , b and c .

Number	0	1	2	3	4
Probability	a	b	$\frac{1}{4}$	$\frac{1}{8}$	c

Answer $a = \dots\dots\dots$, $b = \dots\dots\dots$, $c = \dots\dots\dots$ [3]

- (b) At the end of the day, the total number of customers who took part in the lucky draw was consolidated. Given that 16 customers won the grand prize, find the total number of customers who took part in the lucky draw.

Answer $\dots\dots\dots$ [2]

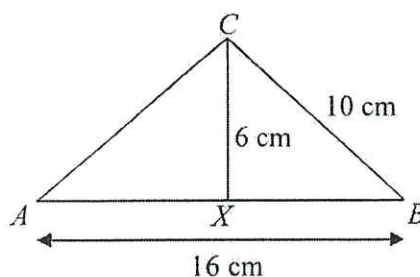
- 17 (a) Evaluate $6 - 2 \tan 60^\circ$, giving your answer correct to 3 significant figures.

Answer [1]

- (b) Given $\sin x = 0.422$, find the acute angle x .

Answer $x = \dots\dots\dots^\circ$ [1]

- (c) The diagram shows a triangle ABC where X is the midpoint, $AB = 16$ cm, $BC = 10$ cm and $CX = 6$ cm.



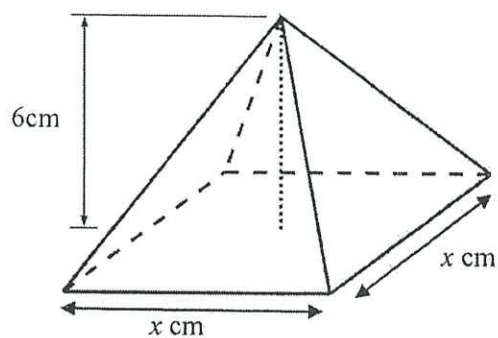
- (i) Show that triangle BXC is a right-angled triangle.

Answer [2]

- (ii) Calculate $\angle ACB$.

Answer $\angle ACB = \dots\dots\dots^\circ$ [3]

- 18 (a) The diagram below shows a pyramid with a square base of side x cm and a height of 6 cm. Given that the volume of the pyramid is 98 cm^3 , find the value of x .



Answer $x = \dots\dots\dots \text{cm}$ [2]

- (b) Uncle Tan, an ice cream vendor, sells biscuit cone filled with soft ice cream and calls it Crunchy Cream Delight. He uses biscuit cone in Figure A, which can be modelled as a cone as shown in Figure B. The height of the cone is 15 cm and its radius is 3.7 cm.

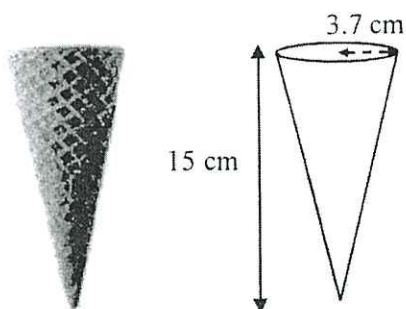


Figure A

Figure B

- (i) Uncle Tan always fills the biscuit cone completely with soft ice cream. After which he tops up with an amount of ice cream to form a hemisphere at the top, as shown in Figure C below.

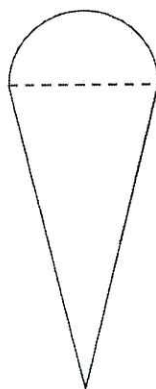


Figure C

Calculate the total volume of ice cream used by Uncle Tan for one Crunchy Cream Delight ice cream.

Answercm³ [3]

- (ii) The cost price of one Crunchy Cream Delight ice cream includes the cost of the biscuit cone and the ice cream.
The cost price of an empty biscuit cone is 30 cents and the cost price of every 10 cm^3 of ice cream is 20 cents.

Uncle Tan is considering changing the biscuit cone to another type, as shown in Figure *D*, which costs 10 cents cheaper. He names it as Frosty Crisp Bliss. He can fill up 350 cm^3 of ice cream in this cone.



Figure *D*

Uncle Tan thinks that using the new biscuit cone can help to lower the cost price and hence increases his profit.

Would you advise Uncle Tan to change to the new biscuit cone?
Support your decision with clear working and reasoning.

Answer

[3]

End of Section B

Yuying Secondary School
EOY 2G3 Mathematics
Marking Scheme for Section A

Qn	Solution	Marks
1(a)	$2x - 10 + 6x + 3 = 9$ $x = 2$	M1 B1
1(b)	$\frac{7y}{3} \geq \frac{2}{5}$ $y \geq \frac{6}{35}$	M1 B1
2(a)	65 : 91 : 70	B2. B1 if 2 correct.
2(b)	$\frac{910}{26} \times 65$ = \$2275	M1 B1
3(a)	$\frac{6}{25} \times 100\%$ = 24%	M1 B1
3(b)	$\frac{25 + 32}{2}$ = 28.5	B1
3(c)	The range of the girls' mark was 37 while the range of the boys' mark was 26. or The distribution of the girls' mark was symmetrical while the boys' mark was not symmetrical	B1
4(a)	$= \frac{4(x-2) + 3(x+1)}{(x+1)(x-2)}$ $= \frac{7x-5}{(x+1)(x-2)}$	M1 B1
4(b)	$= \frac{3}{(y+5)(y-5)} - \frac{2}{y+5}$ $= \frac{3-2(y-5)}{(y+5)(y-5)}$ $= \frac{-2y+13}{(y+5)(y-5)}$	M1 M1 B1

5(a)		B1 if all correct
5(b)	2	B1
5(c)	$\frac{1 \times 5 + 2 \times 8 + 3 \times 2 + 4 \times 2 + 5 \times 2 + 7 \times 1}{20}$ $= 2.6$	M1 B1
6(a)	$(3x-1)^2 = (2x+3)^2 + (x+2)^2$ $9x^2 - 6x + 1 = 4x^2 + 12x + 9 + x^2 + 4x + 4$ $4x^2 - 22x - 12 = 0$ $2x^2 - 11x - 6 = 0 \text{ (shown)}$	M1 M1 B1
6(b)	$(2x+1)(x-6) = 0$ $x = 6 \text{ or } x = -\frac{1}{2}$	M1 B1
7	$4x = 2 - 2y$ $(2 - 2y) + 5y = 8$ $y = 2 \text{ or } x = -\frac{1}{2}$	M1 M1 B2
8(a)	$\frac{PO}{3.6} = \frac{4.2}{7}$ $PO = 2.16 \text{ cm}$	M1 B1
8(b)	$\frac{AC}{AO} = \frac{7}{4.2}$ $AC = 6 \text{ cm}$ $PC = 1.8 \text{ cm}$	M1 B1
9(a)	$5 = \frac{k}{18}$ $y = \frac{90}{x^2 + 2}$	M1 B1

9(b)	$y = \frac{90}{2.25}$ $y = 40$	M1 B1
10	$= \frac{2x^2 - xy}{x} \times \frac{6x - 4y}{6x^2 - 7xy + 2y^2}$ $= \frac{x(2x - y)}{x} \times \frac{2(3x - 2y)}{(3x - 2y)(2x - y)}$ $= 2$	M1 M2, M1 if only 1 wrong B1
11(a)(i)	Alternate angles	B1
11(a)(ii)	Interior angles	B1
11(b)	143°	B1

Qn	Solution	Marks
12(a)(i)	$a^2 - (a+c)(a-c)$ $= a^2 - (a^2 - c^2)$ $= a^2 - a^2 + c^2$ $= c^2$	M1 A1
12(a)(ii)	$999^2 - 1004 \times 994$ $= 999^2 - (999+5)(999-5)$ $= 5^2$ $= 25$	M1 A1
12(b)	$2(x-y)^2 = 128$ $(x-y)^2 = 64$ $x^2 - 2xy + y^2 = 64$ $x^2 + y^2 - 2(20) = 64$ $x^2 + y^2 = 64 + 40$ $x^2 + y^2 = 104$ $\therefore 5(x^2 + y^2) = 104 \times 5$ $5(x^2 + y^2) = 520$	M1 M1 A1
13(a)	$d = kt^2$ $k = \frac{d}{t^2}$ $k = \frac{9.8}{1.4^2}$ $k = 5$	

	$k = \frac{16.2}{1.8^2}$ $k = 5$ $k = \frac{22.05}{2.1^2}$ $k = 5$ $k = \frac{26.45}{2.3^2}$ $k = 5$	 M1
	Since k is a constant for all corresponding values of d and t , d and t are directly proportional.	A1
13(b)	$d = 5t^2$ $d = 5(3.3)^2$ $d = 54.45 \text{ m}$	M1 A1
13(c)	When t is doubled, $d = 5(2t)^2$ $d = 20t^2$ Percentage increase $= \frac{20t^2 - 5t^2}{5t^2} \times 100$ $= 300 \%$	M1 M1 A1
14(a)	$p = 64$	B1
14(c)(i)	76m	A1
14(c)(ii)	4.55 seconds	A1
14(c)(iii)	$3.15 - 0.85 = 2.3$ seconds	A1
15(a)	$5 \text{ cm}^2 : 0.0045 \text{ km}^2$ $1 \text{ cm}^2 : 0.0009 \text{ km}^2$ $1 \text{ cm} : 0.03 \text{ km}$ $\therefore n = 0.03$	M1 A1

15(b)	1 cm : 0.03 km 1 cm : 30 m Actual distance $= 0.8 \times 30$ $= 24$ m	M1 A1
16(a)	$a = \frac{3}{8}$ $b = \frac{1}{4}$ $c = 0$	A1 A1 A1
16(b)	Let x be the total number of customers $\frac{1}{8} = \frac{16}{x}$ $x = 16 \times 8$ $x = 128$	M1 A1
17(a)	2.54 (3 sf)	A1
17(b)	25.0°	A1
17(c)(i)	$BC^2 = 100$ $CX^2 = 36$ $BX^2 = 64$ By converse of Pythagoras' theorem, $BC^2 = BX^2 + CX^2$. Hence, triangle BXC is a right-angled triangle.	M1 A1
17(c)(ii)	$\cos \angle BCX = \frac{6}{10}$ $\angle BCX = \cos^{-1} \left(\frac{6}{10} \right)$ $\angle ACB = 2 \times \cos^{-1} \left(\frac{6}{10} \right)$ $\angle ACB = 106.260\dots$ $\angle ACB \approx 106.3^\circ$	M1 M1 A1
18(a)	$\frac{1}{3} \times x \times x \times 6 = 98$ $2x^2 = 98$ $x^2 = 49$ $x = 7$ cm	M1 A1

18(b)(i)	$\frac{2}{3}\pi \times 3.7^3 + \frac{1}{3}\pi \times 3.7^2 \times 15$ $= 321.1294123$ $\approx 321 \text{ cm}^3 \text{ (3sf)}$	M2 (one mark for vol of hemisphere and one mark for vol of cone) A1
18(b)(ii)	Cost of one Crunch Cream delight $= \frac{321.1294123}{10} \times 0.20 + 0.30$ $= 6.72258824$ $\approx \$6.72 \text{ (2dp)}$ Cost of Frosty Crisp Bliss ice cream $= \frac{350}{10} \times 0.20 + 0.20$ $= \$7.20$ Uncle Tan should not change to the new cone as the cost price of ice cream in the new cone is more expensive compared to the cost price of ice cream in the original cone.	M1 M1 A1