Candidate Name	Class	Register Number	Calculator Model No

CHANGKAT CHANGI SECONDARY SCHOOL

End of Year Examination 2022

Subject	**:**	**Mathematics**
Level	**:**	**Sec 2 Express**
Paper	**:**	**4052/01**
Date	**:**	**12 October 2022**
Duration	**:**	**1 hour 15 minutes**
Setter	**:**	**Mrs Peh**

READ THESE INSTURCTIONS 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 an HB for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **ALL** questions.
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 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 or 3.142, unless the question requires the answer in terms of π.

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 50.

For Examiners' Use	**Marks**
Marks	/ 50
Personal Target	Actual Grade
Parent's / Guardian's Signature	

This document consists of **12** printed pages, including the cover page.

[Turn Over

Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer **all** the questions

1 **(a)** Simplify $5(2x+1)-3$.

Answer ..... [1]

(b) Factorise $xy-6x$.

Answer ..... [1]

---

2 The stem-and-leaf diagram shows the masses, in grams, of 25 kiwi fruits.

7	0	0	1	1	2	5	8
8	2	2	6	8			
9	0	0	0	1	5	9	
10	3	3	5				
11	0	0	0	1			
12	0						

Key 10 | 5 represents 105 grams

For these masses, find

(a) the range,

Answer ..... *grams* [1]

(b) the mean,

Answer .....*grams* [2]

(c) the median,

Answer .....*grams* [1]

(d) the mode.

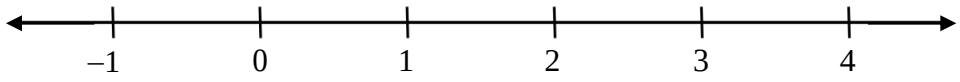
Answer ..... , ...*grams* [1]

[Turn Over

3 **(a)** Solve $6x+1>-3x+28$.

Answer ..... [2]

(b) Represent the solution in **(a)** on the number line provided below. [1]



(c) Write down the smallest possible integer that satisfy the solution in **(a).**

Answer ..... [1]

---

4 Show that $(2n-1)^2+3$ is a multiple of 4 for all integer values of *n*. [2]

Answer

5 Factorise completely $ab-3a+2b-6$.

Answer ..... [2]

---

6 Solve $\frac{2y}{5}-\frac{y-1}{15}=1$.

Answer y = ... [2]

[Turn Over

7 $W = \dfrac{m(v^2 - u^2)}{2}$

(a) Calculate the value of W when $m = 4$, $u = 3$ and $v = 10$.

Answer ..... [1]

(b) Make v the subject of the formula.

Answer ..... [2]

---

8 **(a)** Factorise completely $2x^2 - x - 15$.

Answer ..... [2]

(b) **Hence,** factorise completely $-2(2y-3)^2 + (2y-3) + 15$.
Write your answer as simply as possible.

Answer ..... [2]

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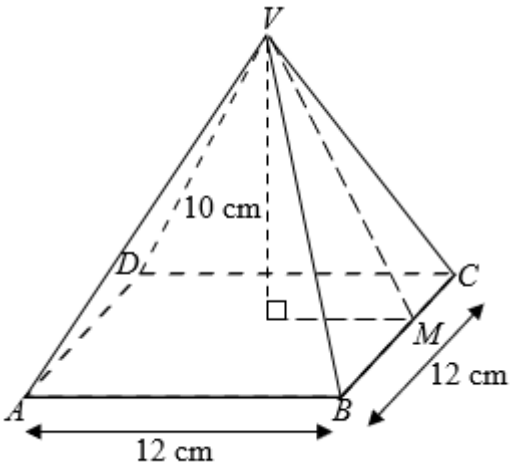
9 The diagram shows a square pyramid *VABCD*. *AB* = *BC* = 12 cm and the height of the pyramid is 10 cm



(a) Calculate the length of VM.

Answer ..... cm [2]

(b) Find the total surface area of the pyramid, leaving your answer to 2 decimal place.

Answer ..... cm^2 [2]

[Turn Over

10 The mass, M grams, of each object is directly proportional to the square of its radius, r centimetres. The object with radius 2 cm has a mass of 100 grams.

(a) Find a formula for M in terms of r.

Answer ..... [2]

(b) Find the mass of the object with a radius 5 cm.

Answer ..... g [1]

(c) The mass of an object is increased by 40%.
Calculate the percentage increase in the radius of the object.

Answer ..... % [2]

11 A bag contains 5 red counters, 8 green counters and 7 blue counters.

(a) A counter is chosen at random and then replaced.
What is the probability that it is **not** a red counter?

Answer ..... [1]

(b) x blue counters are removed from the bag.
The probability of choosing a red counter is now $\frac{1}{3}$.
Find the value of x.

Answer ..... [2]

12 A map of Japan has a scale of 1 : 2 000 000.

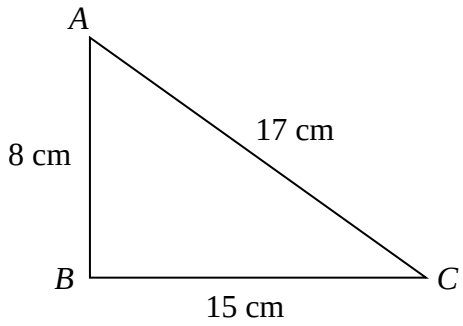
(a) The length of the Yubari river on the map is 6.8 cm.
Calculate the actual length, in kilometres, of the Yubari river.

Answer……. km [2]

(b) The area of Hokkaido is 83 454 km^2.
Calculate the area, in square centimetres, of Hokkaido on the map.

Answer……. cm^2 [2]

13 The diagram shows a triangle ABC, where AB = 8 cm, BC = 15 cm and AC = 17 cm.



(a) Prove that angle $ABC = 90°$.

Answer

…… [2]

…..……

……..……

(b) Find, giving your answers in fraction,

(i) $\cos \angle BAC$,

Answer ..... [1]

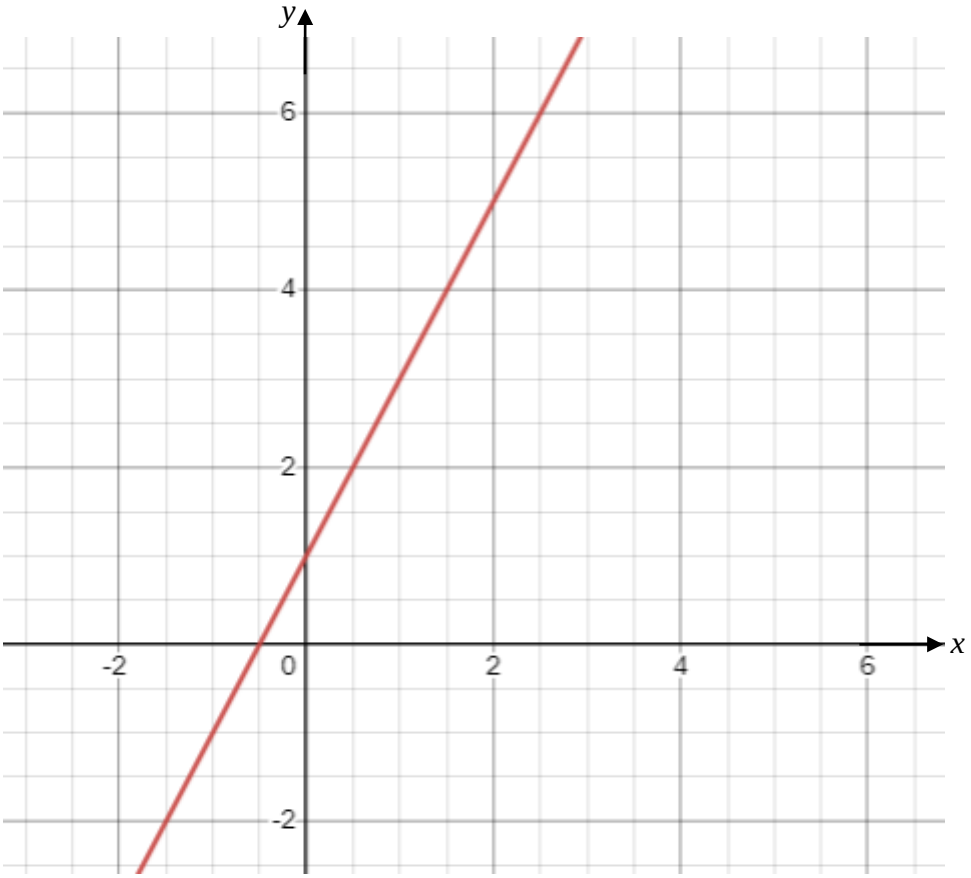
(ii) $\sin \angle ACB$,

Answer ..... [1]

(ii) $\tan \angle ACB$.

Answer ..... [1]

14 The graph below shows the line $y = 2x + 1$.



The table below shows the values of x and y for the line $2x + y = 5$.

x	0	2	3
y	5	***a***	-1

(a) Find the value a.

Answer a = ... [1]

(b) On the grid above, draw and label the line $2x + y = 5$ for $0 \le x \le 3$. [1]

(c) State the gradient of the line $2x + y = 5$.

Answer gradient = ... [1]

(d) Solve the simultaneous equations by the graphical method.

$$y = 2x + 1$$
$$2x + y = 5$$

Answer x = ...

y = ... [2]

End of Paper

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Answer **all** the questions

1 **(a)** Expand and simplify $-y[yz-3(z^2-2yz)]$,

Answer ..... [2]

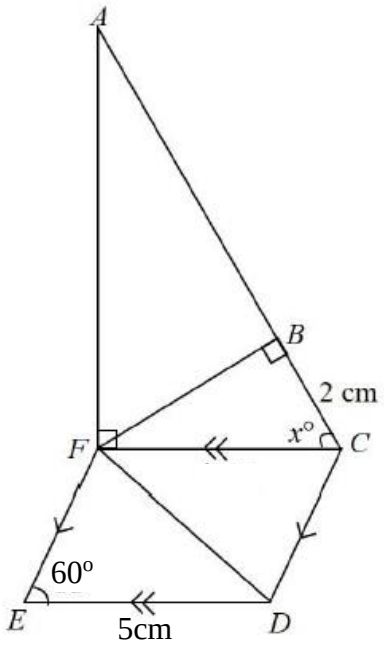
(b) Express $\frac{5p}{3p-q}-\frac{q}{2q-6p}$ as a single fraction in its simplest form

Answer ..... [2]

(c) Given that $a+b=7$ and $a-b=5$, find the value of $6a^2-6b^2$ without solving for a and b.

Answer ..... [2]

2 In the diagram, BC = 2 cm, ED = 5 cm and angle FED = 60° . $EFCD$ is a parallelogram.



(a) Name a triangle that is congruent to triangle *FED*.

Answer ..... [1]

(b) State the

(i) length of *CF*,

Answer .....cm [1]

(ii) angle *FCD*.

Answer .....° [1]

(c) Right-angled triangle *AFC* is similar to right-angled triangle *FBC*.
Calculate

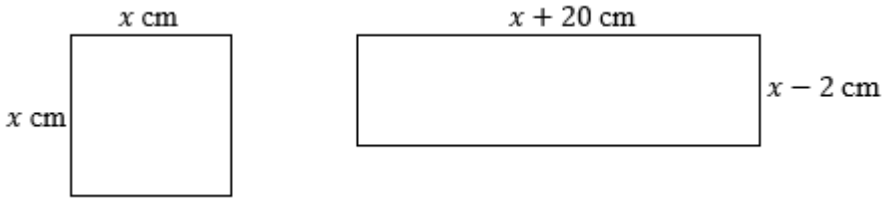
(i) the length of *AC*,

Answer ..... cm [2]

(ii) angle *BCF*.

Answer .....° [2]

3 The side of a square is x cm and the length and breadth of a rectangle are $(x+20)$ cm and $(x-2)$ cm respectively.



(a) Write down an expression for the

(i) area of the square,

Answer..... cm^2 [1]

(ii) area of the rectangle.

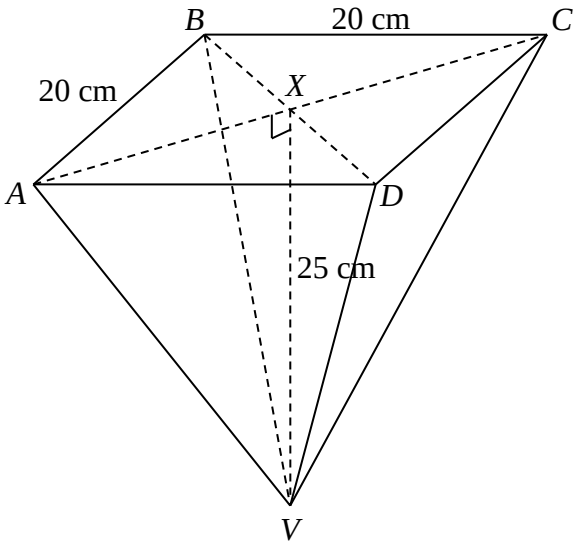
Answer..... cm^2 [1]

(b) If the area of the rectangle is three times the area of the square, form an equation in x and show that it reduces to $x^2 - 9x + 20 = 0$. [2]

(c) Solve the equation $x^2 - 9x + 20 = 0$.

Answer..... [2]

4 Fizzy lemonade is sold in a giant-sized cup filled to the brim. The cup is an inverted square pyramid with sides 20 cm and perpendicular height 25 cm.



(a) Find the volume of fizzy lemonade served in one giant-sized cup, leaving your answer in fraction.

Answer..... cm^3 [2]

(b) Ana bought five cups of giant-sized fizzy lemonade and she poured it into small hemispherical bowls of radius 5 cm. Find

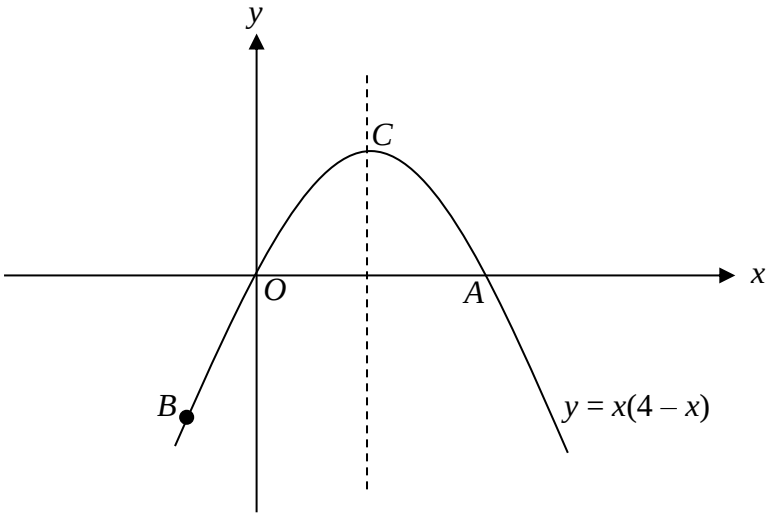
(i) the volume of a hemispherical bowl,

Answer..... cm^3 [2]

(ii) the maximum number of fully-filled bowls Ana can get.

Answer.....bowls [2]

5 The graph of $y = x(4-x)$ cuts the x-axis at the origin and at the point A.



(a) Write down the coordinates of point A.

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

(b) Given that the point $B(-1, y)$ lies on the curve, find the value of y.

Answer y = ... [1]

(c) State the equation of the line of symmetry of the curve.

Answer ..... [1]

(d) Write down the coordinates of the maximum point C.

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

6 Answer the whole of this question on the graph paper, provided on the next page

The variables *x* and *y*.are connected by the equation $y = -\frac{1}{2}(x^2 - x)$.

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

x	- 2	- 1	0	1	2	3	4
y	- 3	- 1	0	*a*	- 1	*b*	- 6

(a) Calculate the value of *a* and *b*.

Answer a = ... [1]

b = ...

(b) Using a scale of 2 cm to represent 1 unit on both axis, draw the graph of [3]

$y = -\frac{1}{2}(x^2 - x)$ for $-2 \le x \le 4$.

(c) State the maximum value of y.

Answer ..... [1]

(d) From the graph, find the

(i) value of *y* when $x = 2.5$,

Answer ..... [1]

(ii) the values of *x* when $y = -3$,

Answer ..... , ... [1]

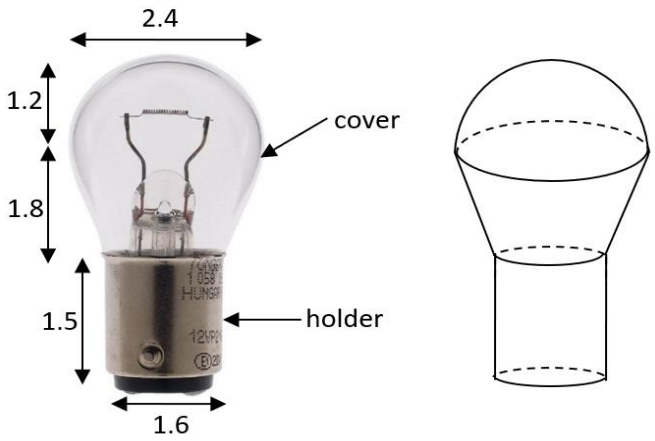
(e) On the graph,

(i) draw and label the line for $y = -1$, [1]

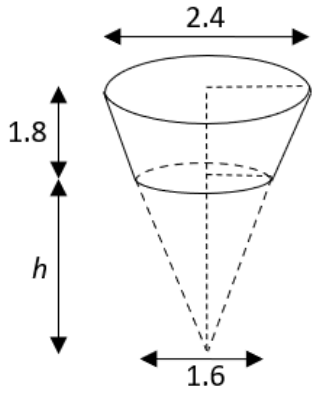
(ii) Solve the equation $-1 = -\frac{1}{2}(x^2 - x)$,

Answer ..... , ... [1]

7 Below is some information about a light bulb which consists of two parts: cover and holder. All the dimensions are given in centimetres.



In this question, the cover can be modelled as a frustum with a hemisphere on top and the holder can be modelled as a smaller cylinder. The frustum is created by removing a cone of height, h from the bigger cone as shown.

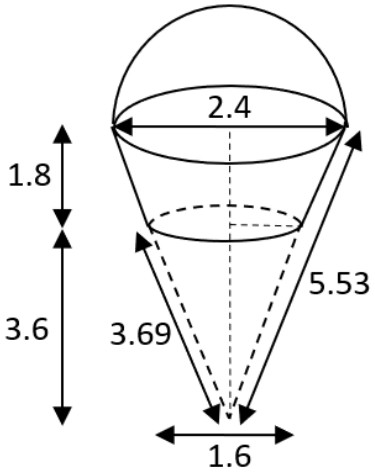


(a) Calculate the volume of the holder.

Answer.....cm^3 [2]

(b) Show that h is 3.6 cm. [2]

(c) Calculate the total surface area of the cover of light bulb, leaving your answer to 3 decimal place.



Answer.....cm^2 [3]

8 The table below shows a comparison chart between light-emitting diode (LED) and compact fluorescent lamp (CFL) bulbs.

	LED	**CFL**
Projected lifespan of each light bulb	25,000 hours	8,000 hours
Cost of light bulb	$59.85 for a pack of 3 bulbs	$2 for one bulb
kWh of electricity used over 100,000 hours	500	700

(a) Over a usage of 100 000 hours, calculate how many of each light bulbs (LED and CFL) are needed?

Answer..... LED light bulbs [2]

..... CFL light bulbs

(b) The electricity tariff for households is 30.17 cents per kWh.
Davian claimed that using LED bulbs over a usage of 100 000 hours gives more value for money. Do you agree with him?
Justify your decision with calculation.

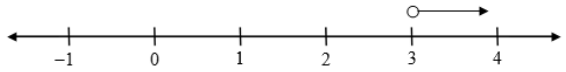
Answer..... [3]

……

……

End of Paper

Marking Scheme for 2E EOY 2022 Paper 1

S/n	Solution
1a	$10x + 2$
1b	$x(y - 6)$
2a	50
2b	Mean $= \frac{2(70)+2(71)+\cdots\ldots+120}{25}$ $=\frac{2272}{25}$ = 90.88
2c	90
2d	90, 110
3a	$9x > 27$ $x > 3$
3b	
3c	4
4	$4n^2 - 2n - 2n + 1 + 3$ $= 4n^2 - 4n + 4$ $= 4(n^2 - n + 1)$ There is a factor of 4, $\therefore (2n - 1)^2 + 3$ is a multiple of 4.
5	$= a(b - 3) + 2(b - 3)$ $= (a + 2)(b - 3)$
6	$\frac{6y}{15} - \frac{y - 1}{15} = 1$ $5y + 1 = 15$ $y = 2.8$
7a	$p = 182$
7b	$\frac{2W}{m} = V^2 - U^2$ $V = \pm\sqrt{\frac{2W}{m} + U^2}$
8a	$x \quad -3 \mid -6x$ $2x \quad +5 \mid +5x$ $2x^2 \quad -15 \mid -x$ $= (x - 3)(2x + 5)$
8b	$-(2(2y - 3)^2 - (2y - 3) - 15)$ $= -(2y - 3 - 3)(2(2y - 3) + 5))$ $= -(2y - 6)(4y - 1)$ $= -2(y - 3)(4y - 1)$ or

	$= 2(-y + 3)(4y - 1)$
9a	$VM = 10^2 + 6^2$ $= \sqrt{136}$ $= 11.7$ cm
9b	$Total\ S.A = (12 \times 12) + 4(\frac{1}{2} \times 12 \times \sqrt{136})$ $= 423.89$ cm^2
10a	$k = 25$ $M = 25r^2$
10b	625 grams
10c	New $M = 1.4\ M$ . . . New $r = \sqrt{1.4r^2}$ $= 1.183r$ % increase $= \frac{1.183r - r}{r} \times 100\%$ $= 18.3\%$
11a	$\frac{3}{4}$
11b	$\frac{1}{3} = \frac{5}{20 - x}$ $x = 5$
12a	20×6.8 $= 136$ km
12b	1 cm^2 : 400 km^2 ? : 383454 Area on map = $\frac{83454}{400}$ = 208.635 cm^2
13a	$AC^2 = 17^2$ $= 289$ $AB^2 + BC^2 = 8^2 + 15^2$ $= 289$ Since $AC^2 = AB^2 + BC^2$, by the converse of Pythagoras Theorem, triangle ABC is a right-angled triangle. Therefore, angle *ABC* is 90°.
13b	(i) $\frac{8}{17}$
	(ii) $\frac{8}{17}$
	(iii) $\frac{8}{15}$
14a	1
14b	All 3 points are plotted correctly. A straight line passing through 3 points are drawn.
14c	-2

14d	$x = 1$ $y = 3$

Marking Scheme for 2E EOY 2022 Paper 2

S/n	Solutions
1a	$-y[yz - 3z^2 + 6yz]$ $= -7y^2z + 3yz^2$
1b	$\frac{5p}{(3p-q)} - \frac{q}{-2(3p-q)}$ $= \frac{10p+q}{2(3p-q)}$
1c	$6(a+b)(a-b)$ = 6(7)(5) = 210
2a	Triangle DCF
2bi	$5\ cm$
2bii	$60°$
2ci	$AC = \frac{5}{2} \times 5$ or $\frac{5}{x+2} = \frac{2}{5}$ $= 12.5$ cm $x = 12.5 - 2$ $AB = 12.5 - 2$ $= 10.5$ $= 10.5$ cm
2cii	$\cos \angle BCF = \frac{2}{5}$ $\angle BCF = 66.4°$
3ai	x^2
3aii	$(x+20)(x-2)$
3b	$(x+20)(x-2) = 3x^2$ $x^2 - 2x + 20x - 40 = 3x^2$ $x^2 - 9x + 20 = 0\ (Shown)$
3c	x -4 | $-4x$ x -5 | $-5x$ x^2 20 | $-9x$ $(x-4)(x-5) = 0$ $x = 4$ or $x = 5$
4a	Volume of popcorn cup $= \frac{1}{3} \times 20 \times 20 \times 25$ $= 3333\frac{1}{3}$ cm^3
4bi	Volume of a bowl $= \frac{2}{3} \times \pi \times 5^3$ $= 83\frac{1}{3}\pi$ cm^3 $= 262$ cm^3
4bii	Max number of bowl $= 5 \times 3333\frac{1}{3} \div 83\frac{1}{3}\pi$ $= 63.66$ $= 63$ cm^3

5a	$A(4, 0)$
5b	$y = -5$
5c	$x = 2$
5d	$C(2, 4)$
6a	$a = 0$ $b = -3$
6b	Refer to graph attached.
6c	$x = \frac{1}{2}$
6di	$-1.9\ (\pm 0.1)$
6dii	$-2\ (\pm 0.1)\ , -3\ (\pm 0.1)$
6ei	$Refer\ to\ graph$
6eii	$-1\ (\pm 0.1)\ , 2\ (\pm 0.1)$
7a	$\text{Volume} = \pi \times \frac{1.6}{2} \times \frac{1.6}{2} \times 1.5$ $= 0.96\pi\ \text{cm}^2$ $= 3.02\ \text{cm}^3$
7b	$\frac{h}{h + 1.8} = \frac{0.8}{1.2}$ $h = 3.6$ (Shown)
7c	Total Surface area of the cover of light bulb $= 2 \times \pi \times 1.2^2 + (\pi \times 1.2 \times 5.53 - \pi \times 0.8 \times 3.69$ $= 6.564\pi\ \text{cm}^2$ $= 20.621\ \text{cm}^2$ (to 3 d.p.)
8a	$\text{No of LED light bulbs} = 100000 \div 25000$ $= 4$ $\text{No of CFL light bulbs} = 100000 \div 8000$ $= 12.5$ $= 13$
8b	Total cost using CFL light bulbs $= (13 \times \$2) + (700 \times \$\frac{30.17}{100})$ $= \$237.19$ Total cost using LED light bulbs $= (2 \times \$59.85) + (500 \times \$\frac{30.17}{100})$ $= \$270.55$ No, I do not agree with Davian because it is \$33.36 cheaper to use CFL light bulbs over 100 000 hours.