MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
CAMBRIDGE ASSESSMENT INTERNATIONAL EDUCATION
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER | S | | | | |

INDEX NUMBER | | | | |

MATHEMATICS

4048/02

Paper 2

October/November 2020

2 hours 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, 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.
DO **NOT** WRITE ON ANY BARCODES.

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 100.

This document consists of **23** printed pages and **1** blank page.

Singapore Examinations and Assessment Board

Cambridge Assessment International Education

DC (CE/CB) 181549/3

[Turn over

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

[Turn over for Question 1]

1 **(a)** Solve the inequality $\frac{2x+1}{2} \geqslant \frac{5-4x}{3}$.

Answer ..... [2]

(b) Solve these simultaneous equations.

$$6x-3y=16$$
$$9x+2y=11$$

Answer $x =$ .....

$y =$ ..... [3]

(c) Express as a single fraction in its simplest form $\frac{x}{(3-2x)^2} - \frac{5}{3-2x}$.

Answer ..... [2]

(d) Simplify $\left(\frac{a^9}{27b^{15}}\right)^{-\frac{1}{3}}$.

Answer ..... [2]

(e) Simplify $\frac{4x^2-16}{3x^2+x-10}$.

Answer ..... [3]

2 A holiday club is open for a morning session and an afternoon session for 5 days each week.
Each child attends every day for either the morning session or the afternoon session.
The children attending are split into three groups, P, Q and R.
The matrix **H** shows the number of children in each group in week 1.

$$\mathbf{H} = \begin{matrix} \\ \text{morning} \\ \text{afternoon} \end{matrix} \begin{matrix} \begin{matrix} \text{P} & \text{Q} & \text{R} \end{matrix} \\ \begin{pmatrix} 10 & 12 & 16 \\ 14 & 16 & 20 \end{pmatrix} \end{matrix}$$

(a) The matrix **B** shows the number of boys in each group.

$$\mathbf{B} = \begin{matrix} \\ \text{morning} \\ \text{afternoon} \end{matrix} \begin{matrix} \begin{matrix} \text{P} & \text{Q} & \text{R} \end{matrix} \\ \begin{pmatrix} 7 & 6 & 8 \\ 6 & 9 & 7 \end{pmatrix} \end{matrix}$$

Find the number of girls attending the afternoon session of group Q.

Answer ..... [1]

(b) Each child is charged a fee for each session.
The session fee is \$30 for group P, \$26 for group Q and \$24 for group R.

Represent the fees in a 3×1 column matrix **F**.

Answer **F** = [1]

(c) Evaluate the matrix $\mathbf{M} = \mathbf{HF}$.

Answer **M** = [2]

(d) State what each element of matrix **M** represents.

.....

..... [1]

(e) Calculate the total amount taken in fees by the club in one week.

Answer $ ..... [1]

(f) In week 2, the number of children attending the club changes.

The number of children attending group P increases by 50%.
The number of children attending group Q increases by 50%.
The number of children attending group R decreases by 25%.

Calculate the percentage change in the amount taken in fees from week 1 to week 2.

Answer ..... [3]

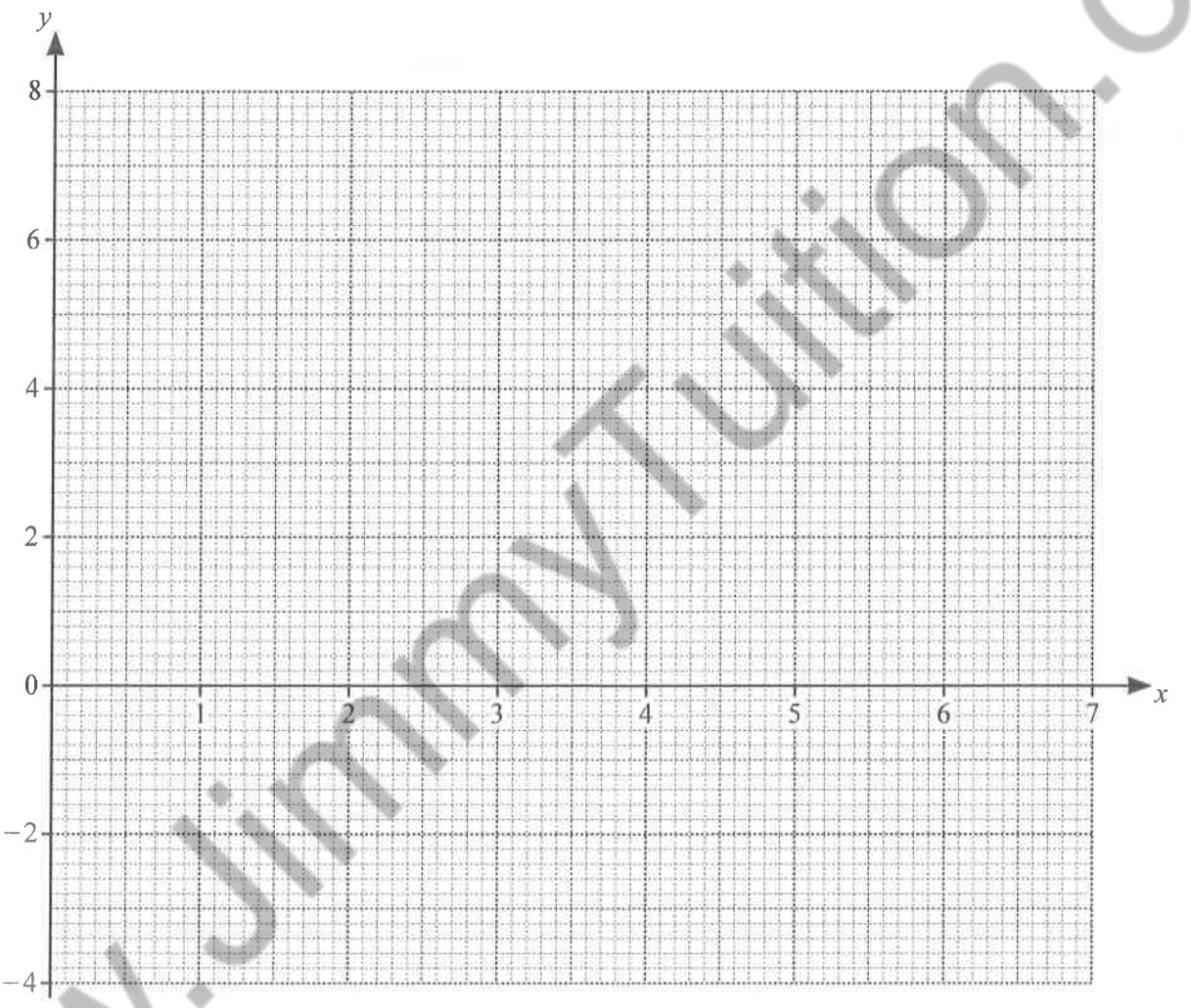
3 **(a)** Complete the table of values for $y = 2x + \frac{6}{x} - 9$.

Give your answer correct to 1 decimal place.

x	0.5	1	1.5	2	3	4	5	6	7
y	4	−1	−2	−2	−1	0.5	2.2	4	

[1]

(b) On the grid, draw the graph of $y = 2x + \frac{6}{x} - 9$ for $0.5 \leqslant x \leqslant 7$.



[3]

(c) Use your graph to find the solutions of the equation $2x + \frac{6}{x} = 10$ in the range $0.5 \leqslant x \leqslant 7$.

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

(d) (i) On the grid in part **(b)**, draw the line $3y = 2x - 3$ for $0 \leqslant x \leqslant 7$.

[2]

(ii) Write down the x-coordinates of the points where this line intersects the curve.

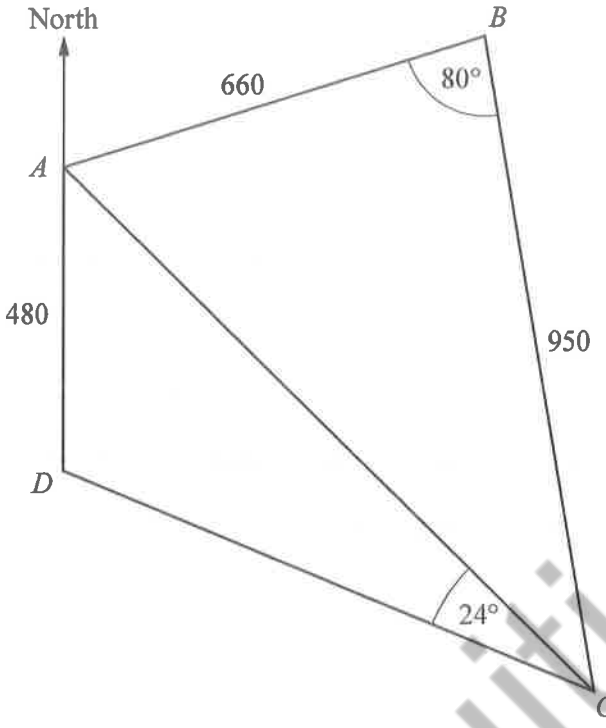
Answer $x =$ ..... and ..... [2]

(iii) These values of x are the solutions of the equation $2x^2 + Ax + B = 0$.

Find the value of A and the value of B.

Answer $A =$ .....

$B =$ ..... [3]



ABCD is a park on horizontal ground crossed by a path *AC*.
A is due north of *D*.
AB = 660 m, *BC* = 950 m and *AD* = 480 m.
Angle *ABC* = 80°, angle *ACD* = 24° and angle *ADC* is obtuse.

(a) Show that *AC* = 1060 m, correct to 3 significant figures.

Answer

[3]

(b) Calculate the bearing of D from C.

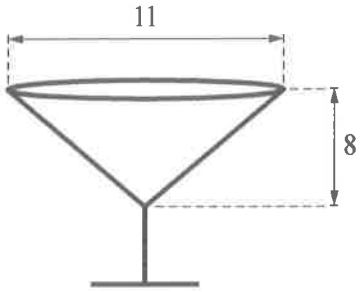
Answer ..... [3]

(c) Sita goes for a jog in the park at a speed of 9.5 km/h.
She starts at A, jogs around the edge to B then C, and then directly back to A.

Calculate the time it takes her to jog this route.
Give your answer in minutes and seconds, correct to the nearest ten seconds.

Answer ..... minutes ..... seconds [3]

5

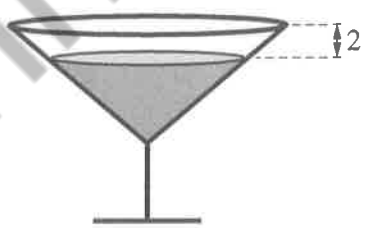


A glass is in the shape of a cone on a stem.
The diameter of the top of the glass is 11 cm.
The height of the cone is 8 cm.
The thickness of the glass is negligible.

(a) Calculate the curved surface area of the inside of the glass.

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

(b)



Amir pours water into the glass.
The surface of the water is 2 cm below the top of the glass.

(i) Amir thinks that the glass is filled to 75% of its total capacity.

Explain why he is wrong.

.....

..... [1]

(ii) Calculate the percentage of the total capacity of the glass that is filled.

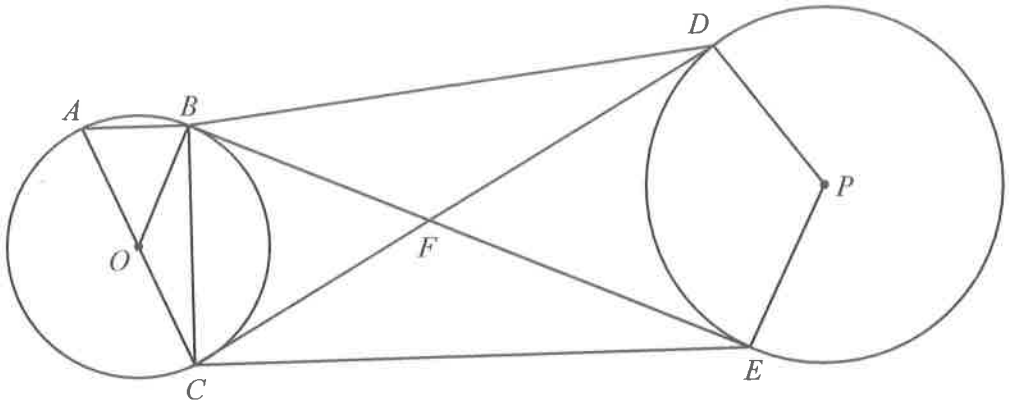
Answer ..... % [2]

(iii) Amir pours the water from this glass into a second glass.
The second glass is in the shape of a cylinder.
The depth of water in the cylindrical glass is 2.5 cm.

Calculate the radius of the cylindrical glass.

Answer ..... cm [4]

6 (a)



A, B and C are points on the circle with centre O.
D and E are points on the circle with centre P.
BFE and CFD are tangents to both circles.
AOC is a straight line.

(i) Show that triangle BDF is congruent to triangle CEF.
Give a reason for each statement you make.

.....

.....

.....

.....

..... [3]

(ii) Angle $OAB = x°$.

Find, in terms of x,

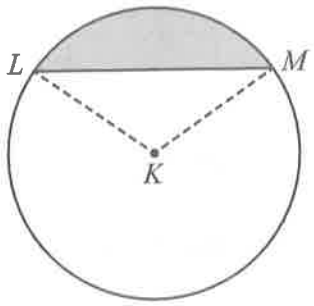
(a) angle OBC,

Answer ..... [1]

(b) angle DPE.

Answer ..... [1]

(b)



The diagram shows a circle, centre K, radius 12 cm.
Angle $LKM = 1.8$ radians.

(i) Calculate the length of the major arc LM.

Answer ..... cm [2]

(ii) Calculate the percentage of the circle that is shaded.

Answer ..... % [4]

7 50 students were each asked how many movies they had watched in the last month.
The results are shown in the table.

Number of movies	0	1	2	3	4	5	6
Frequency	p	10	13	9	6	q	2

The mean number of movies watched by the students was 2.68 .

(a) Find the value of p and the value of q.

Answer $p =$ .....

$q =$ ..... [3]

(b) Calculate the standard deviation.

Answer ..... [1]

(c) 50 adults were also asked how many movies they had watched in the last month.
The results are summarised in the table.

Mean	2.04
Standard deviation	1.92

Make two comparisons between the number of movies watched by the adults and by the students.

1 .....

.....

2 .....

..... [2]

8 $ABCD$ is a parallelogram.
A is the point $(-7, -1)$ and B is the point $(-4, 5)$.
$\overrightarrow{BC} = \begin{pmatrix} 8 \\ -2 \end{pmatrix}$.

(a) Find the length of the line AB.

Answer ..... [2]

(b) Find the equation of the line CD.

Answer ..... [4]

(c) X is the point where the diagonals of the parallelogram intersect.

(i) Find $\overrightarrow{XC}$.

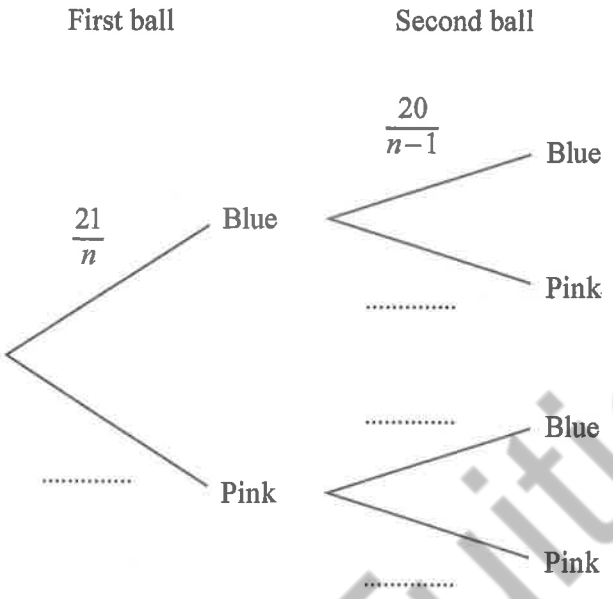
Answer $\overrightarrow{XC} = \begin{pmatrix} \\ \end{pmatrix}$ [2]

(ii) Find the position vector of X.

Answer $\begin{pmatrix} \\ \end{pmatrix}$ [1]

9 A bag contains n balls.
21 of the balls are blue and the rest are pink.
Leon takes two balls from the bag, at random, without replacement.

(a) Complete the tree diagram.



[2]

(b) The probability that Leon takes two pink balls is $\frac{1}{8}$.

Write down an equation to represent this information and show that it simplifies to

$$n^2 - 49n + 528 = 0 .$$

Answer

[3]

(c) Solve the equation $n^2 - 49n + 528 = 0$.

Answer $n =$ ..... or ..... [3]

(d) Explain why one of the solutions in part **(c)** must be rejected.

.....

..... [1]

(e) Find, as a fraction in its simplest form, the probability that Leon takes one blue ball and one pink ball.

Answer ..... [2]

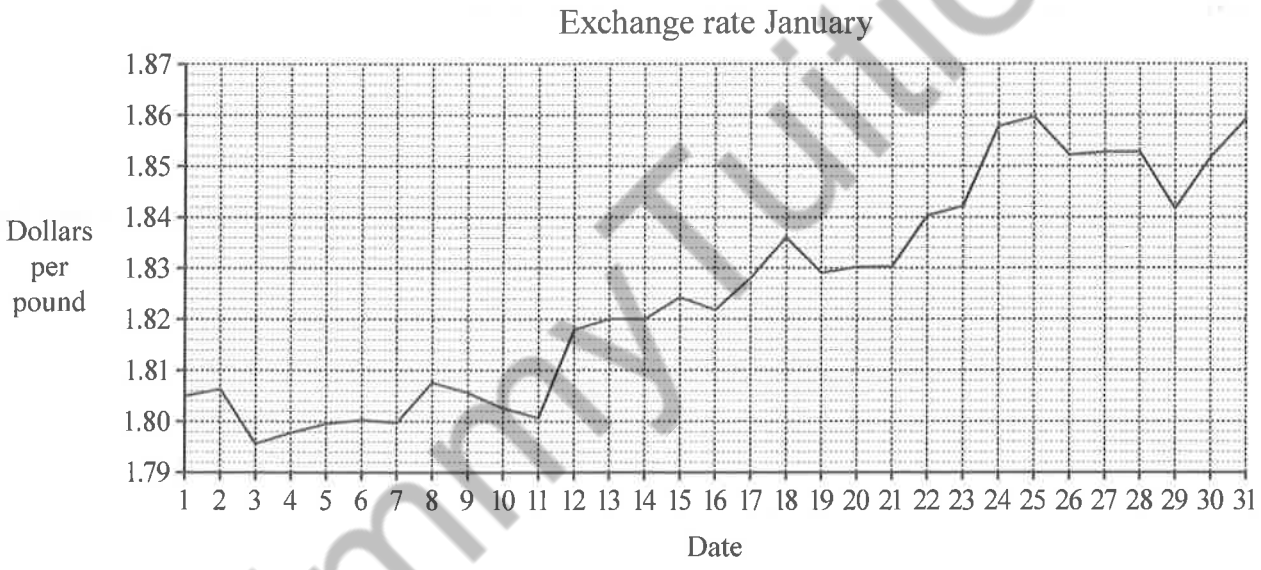
10 Ying is going to study in London for a year.
She needs to work out how much money, in Singapore dollars, she will need to cover her living expenses.
She finds the information below to help her work out her expenses.
The costs are all given in pounds (£).

Accommodation	£217 per week
Student travel pass	£56.90 per month

Estimated student living costs in London

Item	Cost per week
Food and household goods	£60
Personal items	£57
Leisure items	£25
Books and equipment	£15

(a) The exchange rate between pounds and Singapore dollars changes each day.
The graph shows the daily exchange rate for January.



(i) Write down the exchange rate between pounds and Singapore dollars on 15 January.
Give your answer correct to 3 decimal places.

Answer £1 = $ ..... [1]

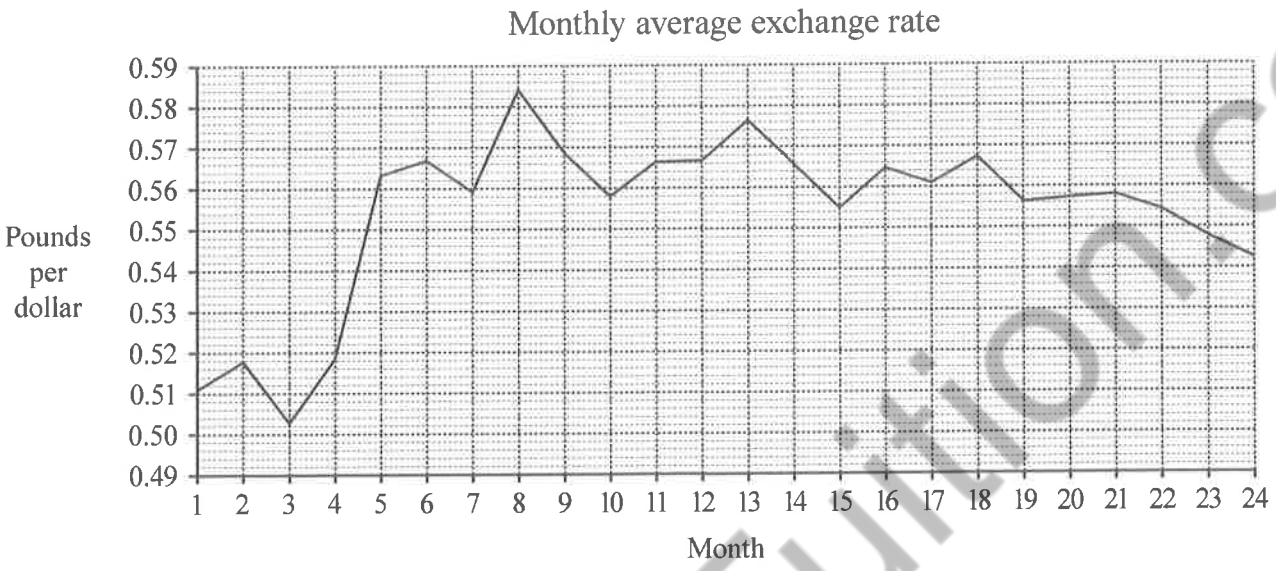
(ii) Ying wants to convert her weekly accommodation cost to dollars.

Use the graph above to work out the difference between the greatest and least possible weekly accommodation costs in dollars.
Give your answer correct to the nearest cent.

Answer $ ..... [3]

(b) Ying's parents will give her an allowance, in dollars, to cover her total costs including accommodation and travel.
She must tell them how much money she will need for the year.
Her parents add an extra 15% to this amount to cover any extra costs.

Ying finds this information about exchange rates over the past two years.



Suggest a suitable amount in dollars for Ying's parents to give her for the year.
Justify any decisions you make and show your calculations clearly.

.....

..... [6]

BLANK PAGE