Rossmoyne Senior High School

WA Exams Practice Paper B, 2015

Question/Answer Booklet

MATHEMATICS APPLICATIONS UNITS 1 AND 2

Section Two: Calculator-assumed

SOLUTIONS

Student Number: In figures | | | | | | | | |

In words _____

Your name _____

Time allowed for this section

Reading time before commencing work: ten minutes
Working time for this section: one hundred minutes

Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer Booklet
Formula Sheet (retained from Section One)

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper, and up to three calculators approved for use in the WACE examinations

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One: Calculator-free	8	8	50	52	35
Section Two: Calculator-assumed	13	13	100	98	65
			Total	150	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2015*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer Booklet.

3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.

4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

5. **Show all your working clearly**. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.

6. It is recommended that you **do not use pencil**, except in diagrams.

7. The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.

See next page

Section Two: Calculator-assumed **(98 Marks)**

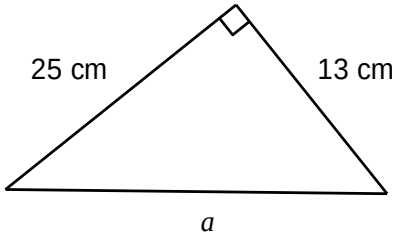
This section has **thirteen (13)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time for this section is 100 minutes.

Question 9 **(5 marks)**

(a) Determine the value of the unknown in each triangle below.

(i) (1 mark)

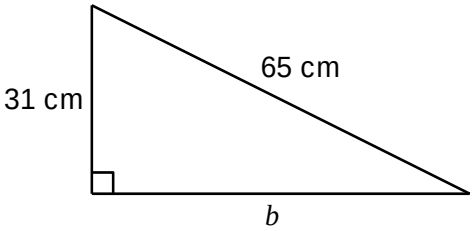


$a^2 = 25^2 + 13^2$

$a = \sqrt{794}$

$= 28.2$ cm

(ii) (1 mark)



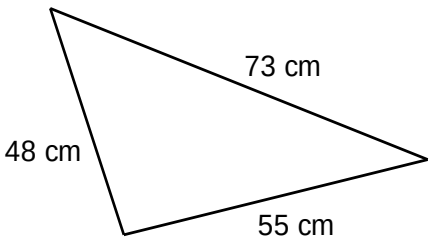
$31^2 + b^2 = 65^2$

$b = \sqrt{3264}$

$= 57.1$ cm

(b) Use Pythagoras' Theorem to determine whether the triangle sketched below, not to scale, is right angled.

(3 marks)



$48^2 + 55^2 = 5329$

$73^2 = 5329$

Hence $48^2 + 55^2 = 73^2$ and so triangle must be right angled.

See next page

Question 10 **(9 marks)**

(a) A shop sells a brand of margarine in two different sizes: 550g for \$4.95 and 200g for \$1.75. Which size is the 'best buy'? Explain your answer. (3 marks)

Large: $495 \div 550 = 0.9$ c/g

Small: $175 \div 200 = 0.875$ c/g

Hence SMALL size is slightly cheaper per gram than the large and so is the best buy.

(b) Three people bought a \$4 500 painting as an investment. Aki and Beth contributed \$2 400 and \$1 200 respectively, with Ching putting in the rest.

(i) What percentage of the \$4 500 did Ching contribute? (2 marks)

$$4500 - 2400 - 1200 = 900$$

$$\frac{900}{4500} \times 100 = 20\%$$

Two years later, the painting was sold for \$7 500.

(ii) Calculate the percentage profit made by selling the painting. (2 marks)

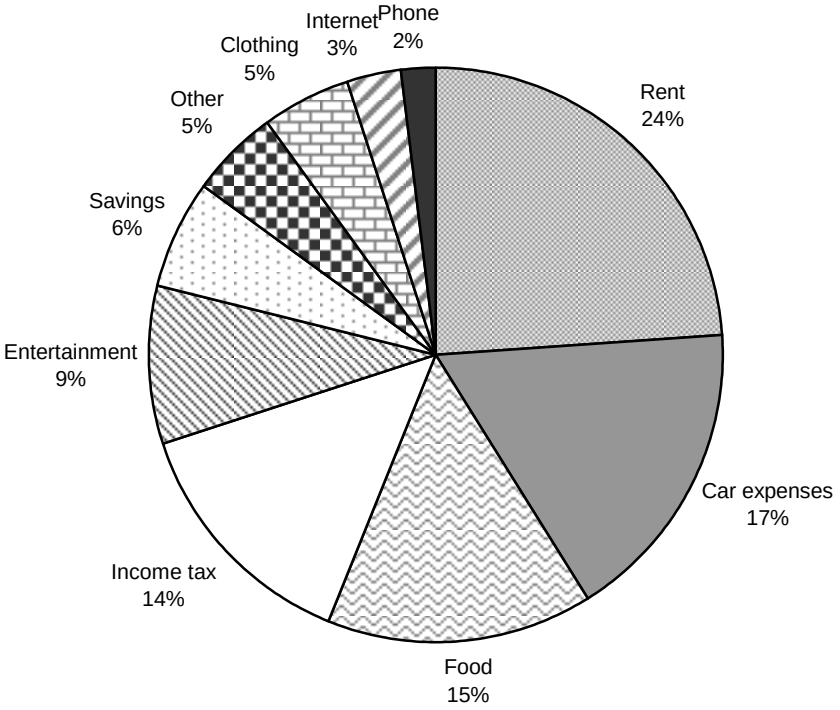
$$\frac{7500 - 4500}{4500} \times 100\% = 66.7\%$$

(iii) The three people shared the \$7 500 sale proceeds in proportion to their contributions. How much did Ching receive? (2 marks)

$$7500 \times 20\% = \$1500$$

Question 11 **(6 marks)**

As part of preparing a budget, a young person kept a record of what they did with all of the income that they received from a full-time job. The chart below shows that they spent 24% of their income on rent, with decreasing amounts spent on car expenses, food and so on.



This table shows the income of the young person for four months of 2014.

Month	April	May	June	July
Income	\$3 646	\$3 757	\$3 532	\$4 185

(a) The person spent exactly 50% of their income on rent, car expenses and one other category. What was this category? (1 mark)

24%+17%=41%. 9% = Entertainment.

(b) What total percentage of their income went on income tax and savings? (1 mark)

$14\% + 6\% = 20\%$

(c) Calculate how much they spent on clothing in July. (2 marks)

$4185 \times 5\% = \$209.25$

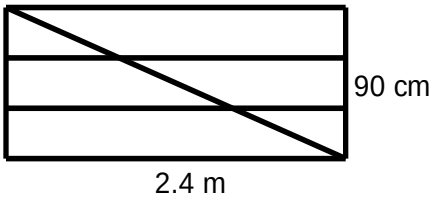
(d) In which month did they spend just under \$530 on food? Justify your answer. (2 marks)

June, since
$3532 \times 15 \div 100 = \$529.80$

See next page

Question 12 **(8 marks)**

A rectangular paddock gate 2.4 m wide and 90 cm tall is made by welding lengths of steel tubing together as shown in the diagram.



(a) Calculate the length of steel tubing needed for the diagonal, to the nearest cm. (2 marks)

$240^2 + 90^2 = 65700$

$\sqrt{65700} = 256$ to nearest cm

(b) Calculate the length of steel tubing required to construct the gate, rounded up to the nearest whole metre.

(2 marks)

$4 \times 2.40 + 2 \times 0.90 + 2.56 = 13.96$ m

≈ 14 m

(c) What acute angle, to the nearest degree, does the diagonal make with the horizontal lengths of tubing? (2 marks)

$\tan \theta = \frac{90}{240}$

$\theta = 20.56$

$\approx 21°$

(d) Another rectangular gate was made with a similar design and a height of 90 cm. In this gate, the angle between the diagonal and the vertical side of the gate was 59°. Determine the width of this gate. (2 marks)

$\tan 59 = \frac{w}{90}$

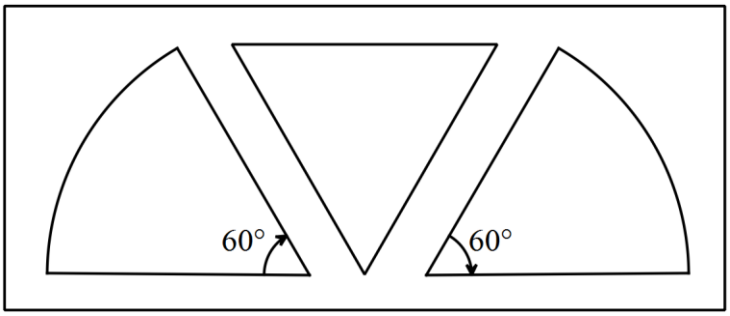
$w = 149.8$

≈ 150 cm

See next page

Question 13 **(7 marks)**

A stencil is made by removing an equilateral triangle of side 24 cm and two sectors, both of radius 24 cm and angle 60°, from a rectangular sheet of cardboard measuring 70 cm by 30 cm, as shown in the sketch below.



(a) The resulting interior edges of the stencil are sealed with a thin plastic strip. Determine the length of plastic strip required. (2 marks)

$$\frac{60}{360} \times 2 \times \pi \times 24 = 25.13$$

$$2 \times 25.13 + 7 \times 24 = 218.3 \text{ cm}$$

(b) Show use of Heron's rule to determine the area of the equilateral triangle. (2 marks)

$$s = \frac{24 + 24 + 24}{2}$$
$$= 36$$

$$A = \sqrt{36(36 - 24)(36 - 24)(36 - 24)}$$
$$= 249.4$$

(c) Determine the area of cardboard remaining after the equilateral triangle and two sectors are removed from the rectangle. (3 marks)

$$A_1 = \frac{60}{360} \times \pi \times 24^2$$
$$= 301.6$$

$$A_2 = 30 \times 70$$
$$= 2100$$

$$A = 2100 - 2 \times 301.6 - 249.4$$
$$= 1247.4 \text{ cm}^2$$

See next page

Question 14 **(9 marks)**

A student went for a run every morning during the month of June along a variety of routes. The time taken for each run was recorded to the nearest minute and the data is shown below, after the times have been sorted from smallest to largest.

17, 18, 19, 20, 21, 21, 22, 23, 23, 24, 24, 25, 25, 25, 25,
26, 26, 26, 27, 27, 27, 28, 30, 30, 30, 31, 33, 33, 34, 35.

The mean of these 30 times is 25.8 minutes and the standard deviation is 4.6 minutes.

(a) For the times recorded in June, what is their

(i) median? (1 mark)

25.5 minutes

(ii) range? (1 mark)

$35 - 17 = 18$ minutes

(b) Use the above data to complete this frequency table. (1 mark)

Run time (minutes)	Number of days
16 - 18	2
19 - 21	4
22 - 24	***5***
25 - 27	10
28 - 30	4
31 - 33	***3***
34 - 36	2

See next page

The following month the student continued their morning runs. The 31 times for July are shown in the table below.

Run time (minutes)	Number of days
13 - 15	4
16 - 18	4
19 - 21	3
22 - 24	7
25 - 27	8
28 - 30	3
31 - 33	2

(c) For the times recorded in July, determine the mean and standard deviation. (2 marks)

$\overline{x} = 22.7$ minutes

$\sigma_X = 5.2$ minutes

(d) In which month were the run times more consistent? Justify your answer with reference to suitable statistics. (2 marks)

The June times were more consistent.

This can be justified by noting that the standard deviation for June is smaller than that of July (4.6 < 5.2).

(e) Is there evidence that the student is running faster in July compared to the previous month? Justify your answer. (2 marks)

No.

Although the mean time for the runs has decreased, we do not know that the run times have been collected over the same distance and so cannot infer speeds from the data.

See next page

Question 15 **(6 marks)**

A computer store is offering a new netbook for sale at a cash price of $665.

(a) The store is offering a finance deal based on a 20% deposit followed by 12 monthly payments of $59.75. How much would a customer pay in total for the netbook using this deal? (2 marks)

$665 \times 0.2 = 133$

$12 \times 59.75 = 717$

$717 + 133 = \$850$

(b) A student borrows the full cash price for 4 months from a lender who charges a flat rate of 13.8% pa. How much do they have to repay the lender, including interest? (2 marks)

$$\frac{665 \times 13.8 \times {}^{4}/_{12}}{100} = 30.59$$

$665 + 30.59 = \$695.59$

(c) A business buys a new netbook for cash. Determine the value of the netbook after three years if it is assumed that it depreciates by 30% pa. (2 marks)

$665 \times 0.7^3 = 228.095$

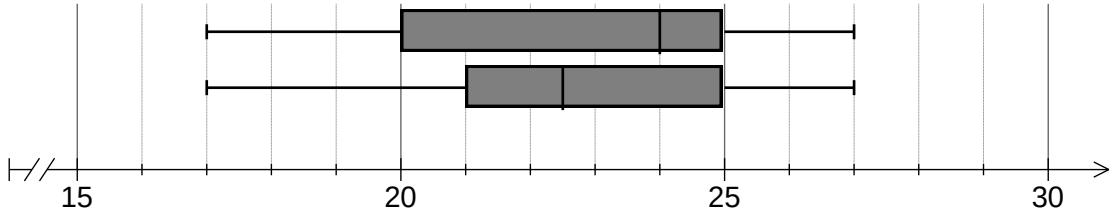
$\approx \$228$

See next page

Question 16 **(10 marks)**

37 students in a school sat a Chemistry test that had a maximum possible score of 40.

The scores of the 19 students in Class M are summarised in this boxplot.



(a) State the interquartile range for the scores of Class M. (1 mark)

5 marks

(b) One student in Class M scored 27 out of 40. If they had scored an extra five marks, would their score be considered an outlier for the class? Justify your answer. (2 marks)

$1.5 \times 5 = 7.5$
$25 + 7.5 = 32.5$
Score of $27 + 5 = 32$ is below $1.5 \times$IQR above Q_3, so not outlier.

The scores of the remaining students, in Class P, are listed below in ascending order.

17	18	19	20	21	21
22	22	22	23	24	25
25	25	26	26	26	27

(c) Construct a boxplot for these 18 scores on the above diagram, next to that for Class M. (3 marks)

(d) Explain which class

(i) performed better in the test (2 marks)

Class M - had a higher median of 24 compared to 22.5 for Class P.

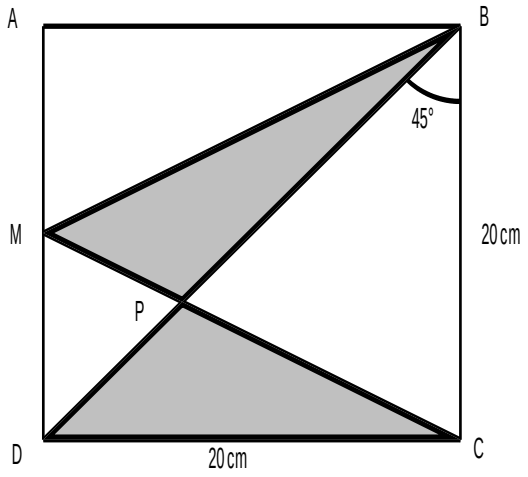
(ii) had the least skewed marks (2 marks)

Class P - It's quartiles are fairly equal in width, but Class M has positive skew - width of upper half much less than width of lower half of boxplot.

See next page

Question 17 **(8 marks)**

An outline of a company logo is shown below. ABCD is a square of side 20 cm, M is the midpoint of side AD and P is the point of intersection of the lines BD and CM.



(a) Write down an equation involving the sine, cosine or tangent ratio that could be used to determine that $\angle DCM$ is 26.6°. (1 mark)

$$\tan\angle DCM = \frac{10}{20}$$

(b) Calculate the size of

(i) $\angle BCP$. (1 mark)

$$90 - 26.6 = 63.4°$$

(ii) $\angle BPC$. (1 mark)

$$180 - 45 - 63.4 = 71.6°$$

See next page

(c) Using trigonometry, calculate the length BP. (3 marks)

$$\frac{20}{\sin 71.6^\circ} = \frac{BP}{\sin 63.4^\circ}$$

$$BP = 18.8 \text{ cm}$$

(d) Determine the area of triangle BPC to the nearest square centimetre. (2 marks)

$$\text{Area} = \frac{1}{2} \times 20 \times 18.8 \times \sin 45^\circ$$

$$\text{Area} = 133 \text{ cm}^2$$

Question 18 **(6 marks)**

(a) A sphere has a radius of 5 cm and cube has a side length of 80 mm. Which solid has the greatest volume, and by how much? (3 marks)

$$V_S = \frac{4}{3} \times \pi \times 5^3$$
$$= 523.6$$

80 mm = 8 cm

$$V_C = 8^3$$
$$= 512$$

$$523.6 - 512 = 11.6$$

Sphere has greatest volume by 11.6 cm^3

(b) What is the side length of a cube that has the same surface area as a cylinder with a height of 20 cm and a radius of 8 cm? Round your answer to 1 decimal place. (3 marks)

$$A_{CYL} = 2 \times \pi \times 8 \times 20 + 2 \times \pi \times 8^2$$
$$= 1407.4$$

$$A_C = 6l^2$$

$$6l^2 = 1407.4$$
$$l^2 = 234.6$$
$$l = \sqrt{234.6}$$
$$l = 15.3 \text{ cm (1dp)}$$

See next page

Question 19 **(8 marks)**

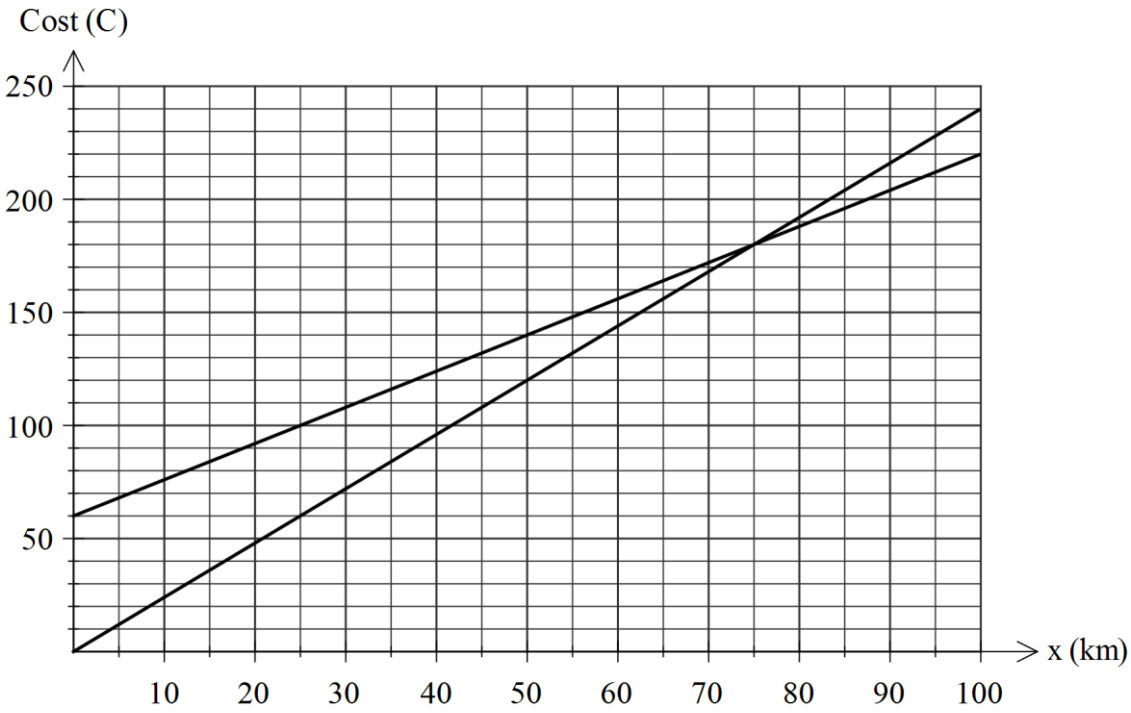
A family want to hire a car for two days whilst visiting a city and there are two companies to choose from.

Wheels charge \$30 per day plus \$1.60 per kilometre, whilst Bettacar have no daily fee but charge \$2.40 per kilometre.

(a) Complete the table of values below to show the cost of hiring a car for two days from Wheels. (2 marks)

Kilometres (x)	20	40	60	80
Cost (\$ C)	92	**124**	**156**	188

(b) On the axes below, plot the cost of hiring a car from Wheels. The cost of hiring a car from Bettacar has already been plotted. (2 marks)



(c) Write a rule to calculate the cost of hiring a car from Bettacar for a distance of x kilometres. (1 mark)

$C = 2.4x$

(d) The family want to keep the amount they spend on car hire to a minimum. Explain which company they should choose, depending on how far they intend to travel. (3 marks)

Both companies cost the same for 75 km.
If they plan to travel less than 75 km, they should choose Bettacar, but otherwise they should choose Wheels.

See next page

Question 20 **(8 marks)**

A hardware store sells 300 mL cans of stain for \$7 and larger, 500 mL cans, of the same product for \$11. The manufacturers estimate that 75 mL of stain will cover one square metre of decking.

(a) Determine the area of decking that could be stained with two 300 mL cans. (1 mark)

$$\frac{2\times 300}{75}=8 \text{ m}^2$$

(b) Determine how many large cans that should be purchased in order to cover a rectangular deck measuring 3.6 by 4.8 metres. (3 marks)

$$3.6\times 4.8=17.28 \text{ m}^2$$

$$17.28\times 75=1296 \text{ mL}$$

$$1296\div 500=2.592$$

$$\approx 3 \text{ large cans}$$

(c) A customer buys 12 litres of stain for \$272 by purchasing x of the smaller cans and y of the larger cans.

(i) Write an equation, involving x and y, for the cost of the paint. (1 mark)

$$7x+11y=272$$

(ii) Write another equation, involving x and y, for the amount of paint bought. (Note that one litre is the same as 1 000 mL) (1 mark)

$$0.3x+0.5y=12$$

(iii) Solve your two equations simultaneously to determine how many of each size can were bought. (2 marks)

$x=20$, $y=12$

20 small cans and 12 large cans.

See next page

Question 21 **(8 marks)**

The lengths, X, of plastic pipes produced by a machine are normally distributed with a mean of 302 cm and a standard deviation of 1.5 cm.

(a) A pipe is chosen from the production line and has a length of 305 cm.

(i) How many standard deviations from the mean is the length of this pipe? (1 mark)

$$\frac{305-302}{1.5}=2 \text{ sd's}$$

(ii) 95% of the pipes produced by the machine will lie within k cm of the mean. Use the 68%, 95%, 99.7% rule to determine the value of k. (2 marks)

95% lie within 2 sd's of mean: $k=1.5\times 2=3$

(b) A pipe is chosen at random from the production line. Determine $P(X>301)$. (1 mark)

$$P(X>301)=0.7475$$

(c) 65 randomly chosen pipes are packed into a crate. Estimate how many of these pipes would be shorter than 300 cm. (2 marks)

$P(X<300)=0.0912$

$0.0912\times 65=5.93$

Expect 6 of the pipes to be shorter than 300 cm.

(d) An average of one out of every eight pipes produced by the machine exceeds l cm. Determine the value of l, rounding your answer to four significant figures. (2 marks)

$P(X>l)=\frac{1}{8}$

$l=303.7255$

≈ 303.7 to 3 sf

End of questions

Additional working space

Question number: _____

Additional working space

Question number: _____

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