

2024 VCE Foundation Mathematics external assessment report

General comments

There was strong engagement with the questions and some excellent responses. The following information may be helpful to remember when completing examinations.

Students should make good use of their reading time and ensure they read questions carefully to identify important information. For example, they should take note when a question requires them to 'show that' or to use calculations from an earlier response.

If a pencil is used, students should make sure it has 2B or darker lead, as the papers are scanned. Some light-coloured or erasable pens do not scan properly.

After completing their responses, students should re-read questions to make sure they are providing answers for all parts of the question and in the manner required, and that calculated numbers represent 'realistic' values within the context of the question. For example, if a student calculates that a single biscuit weighs several kilograms, they should carefully check their work.

Appropriate working and steps showing the students' thinking must be present in responses to questions worth more than one mark. Numerous responses quoted only the final answer, allowing no opportunity for a partial mark to be awarded. Students should be encouraged to show as much working as possible with any question they answer, ensuring their calculations are algebraically correct and do not include 'chains' or 'run-on' equal signs.

Students should be careful with their handwriting. Letters, words, digits, numbers and symbols should be clear and written in a neat and readable form. Students should take care to ensure that digits that may appear similar, such as 4 and 9, are clearly identifiable.

Students need to practise 'show that' questions. There were five in this paper: Questions 2b, 7b.i, 8a, 9a and 9c. This type of question requires that appropriate working is shown to support the development of an answer, that statements are algebraically correct and clearly set out, and that a logical conclusion is drawn. Incorrect mathematical statements such as $12 \times 0.5\% = 6\% \times \$41\,2531.59 = \$24\,751.90$ were quite common and should be separated out over multiple lines or as smaller succinct calculations to ensure accuracy and clarity.

Some students provided answers that were not rounded correctly or were not written to the required accuracy or the correct number of significant figures. Many questions require this style of response, and students are encouraged to revise the appropriate skills regularly throughout the year.

Rounding numbers should only occur at the final step of the solution and not at any prior steps. The accumulated rounding error that occurs at intermediate steps will often result in an inaccurate final value. Questions 2a, 3b and 10a involved this type of thinking. Students are encouraged to practise the skill of 'carrying' accuracy throughout intermediate steps.

Specific information

This report provides sample answers or an indication of what answers may have included. Unless otherwise stated, these are not intended to be exemplary or complete responses.

The statistics in this report may be subject to rounding resulting in a total more or less than 100 per cent.

Section A – Multiple-choice questions

The table indicates the percentage of students who chose each option. Grey shading indicates the correct response.

Question	Correct answer	% A	% B	% C	% D	% N/A	Comments
1	C	16	6	75	3	0	Green : Blue = 1 : 2 $\Rightarrow 250 \text{ ml of green} = 500 \text{ ml of blue}$
2	A	24	35	32	8	2	Approx = $8 \times 90 = 720$ / actual = $8 \times 92 = 736$ $\% \text{ error} = \frac{736 - 720}{736} \times 100\% = 2.17\%$
3	D	2	28	17	53	0	cost = $0.24 \times 24 \times 365 \times 0.18 = \378.43
4	C	54	7	37	2	0	1.6 kg = 1600 g $\text{cook time} = 15 + \frac{1600}{20} = 95 \text{ min}$
5	C	24	41	25	9	1	Extending the lines gives an intersection point of (60, 80). Ambulance has travelled $180 - 80 = 100 \text{ km}$
6	A	34	15	38	12	0	Recommended is 100% Vegemite (1) + chips + noodles + roll $= (20/2) + 24 + 47 + 49 = 130\%$ exceeds by 30%
7	D	2	3	12	84	0	Employee C has a higher rating for leadership than employees A and B.
8	C	3	2	86	9	0	Netflix and Stan.
9	B	6	67	5	22	1	Mean number of points for 1st place = 33.6 Mean number of points for 4th place = 28 Difference in mean values = 5.6
10	B	31	52	9	7	0	$\frac{260}{1064} \times 100\% = 24.44\%$ observation gives 7 sources

Question	Correct answer	% A	% B	% C	% D	% N/A	Comments
11	A	54	15	19	10	1	Commission $= 4\% \times \$200\,000 + 2\% \times \$400\,000 + 1.5\% \times \$400\,000$ Commission = \$22 000
12	B	16	64	14	5	0	Selling price = marked up price + GST $= 140\% \times \$4.50 + 10\% \times (140\% \times \$4.50)$ Selling price = \$6.93
13	D	16	8	22	53	1	$r = \frac{(11937.50 - 10\,000) \times 100}{10\,000 \times 5} = 3.875\%$
14	D	5	12	13	68	1	Repayment on \$67 450 = $3\% \times \$67\,450$ Repayment on \$67 450 = \$2023.50
15	B	15	73	9	2	0	Fee = $\$10 + 3 \times \7 Fee = \$31
16	C	18	18	56	7	1	$0.64\text{ m} = 64\text{ cm} / 64 \div 4 = 16\text{ increments}$ $\text{vol} = 1600 \times 16 = 25\,600\text{ L}$
17	D	23	21	30	24	2	$4\text{ mm} = 0.4\text{ cm}$ $\frac{0.4}{2.54} = 0.1575'' / \frac{5}{64} = 0.078'' / \frac{3}{32} = 0.094'' /$ $\frac{1}{8} = 0.125'' / \frac{5}{32} = 0.15625''$
18	A	54	22	16	7	0	$200 \pm 4\% \times 200 = 200 \pm 8$
19	C	14	8	70	8	1	Perth time is two hours earlier than Melbourne time. $\Rightarrow 6:45\text{ pm in Melb. is } 4:45\text{ pm in Perth.}$
20	B	30	32	24	12	1	First column: the hexagon is made of 6 equilateral triangles of side length 4 cm, so it has width = 8 cm all other columns: width adds 6 cm 38 cm horizontally creates 6 columns of shapes $(1 \times 8 + 5 \times 6)$ Hexagonal shape height $\approx 6.92\text{ cm}$ 28 cm vertically, generates in each alternate column, 4 and 3 full hexagonal shapes respectively. Number of full shapes = $3 \times 4 + 3 \times 3 = 21$

Section B

Question 1a.

Marks	0	1	Average
%	2	98	1.0

ACT

This question was answered well.

Question 1b.

Marks	0	1	Average
%	20	80	0.8

Difference in percentage = $76 - 44 = 32\%$

This question was answered well.

Question 1c.

Marks	0	1	Average
%	56	44	0.5

NT capital city : NT outside capital city

60 : 40

3 : 2 or $\frac{3}{2}$

Many students recognised the need to find a ratio; however, they had difficulty simplifying their response, with common incorrect answers being 15:10 or 6:4.

Other incorrect responses listed the ratio in the wrong order and without identifiable labels.

Question 1d.

Marks	0	1	2	Average
%	41	20	39	1.0

$$\frac{5\,207\,145}{\text{Res. land area}} = 521.5$$

$$\Rightarrow \text{Residential land area} = \frac{5\,207\,145}{521.5} = 9984.93768 \approx 9985$$

Many students correctly substituted values into the rule but were unsure how to proceed to find a solution. Common incorrect responses multiplied the two values together ($521.5 \times 5\,207\,145$) or included an index without the units (9984.94^3).

Question 2a.

Marks	0	1	Average
%	23	77	0.8

$$\begin{aligned}\text{max price} &= \$379.90 \times 3 \\ &= \$1139.70\end{aligned}$$

This question was answered well.

Incorrect responses often added the values of one A reserve, one B reserve and one C reserve ticket, rather than three A reserve tickets. Other answers rounded the total to the nearest whole number, ignoring the cents component.

Question 2b.

Marks	0	1	2	Average
%	53	14	34	0.8

$$\text{Maximum authorised cost} = \$239.90 \times 2 \times 1.1 = \$527.78$$

$$\text{Resale price} = \$530$$

$$\$530 > \$527.75 \text{ (resale} > \text{ authorised)}$$

Sale is not authorised

OR

$$\text{Max authorised cost/ticket} = \$239.90 \times 1.1 = \$263.89$$

$$\text{Resale cost/ticket} = \$265. \text{ (resale} > \text{ authorised)}$$

Sale is not authorised

OR

$$\begin{aligned}\% \text{ of original price} &= \frac{530}{2 \times 239.9} \times 100\% \\ &= 110.46\%\end{aligned}$$

increase > 10%

Sale is not authorised

Many students found the 10% value but subtracted rather than added. Others mentioned 10% but did not calculate the value. Explanations often did not compare or provide a reason why the requirements were not met.

Question 2c.

Marks	0	1	2	Average
%	68	3	29	0.6

Let the integers B and D represent the number of tickets bought in reserves B and D respectively. Then,

$$B + D = 42$$

$$309.9B + 199.9D = 10\,265.80$$

$$\Rightarrow D = 42 - B$$

$$\text{and } 309.9B + 199.9(42 - B) = 10265.80$$

$$110B = 10265.80 - 8395.80$$

$$110B = 1870$$

$$\Rightarrow B = 17$$

\Rightarrow The number in B reserve = 17 and the number in D reserve = $42 - 17 = 25$.

Many students were unable to write either of the simultaneous equations, and those that could were unable to solve them to find a solution.

Some students did solve the problem using other alternative approaches including 'guess and check'.

Question 3a.

Marks	0	1	Average
%	36	64	0.7

$$\text{Total weight} = 250 + 125 + 43 + 2 + 100 = 520 \text{ g} = 0.52 \text{ kg}$$

This question was answered well.

A common error was converting the units incorrectly, indicating the weight was 5.2 kg.

Question 3b.

Marks	0	1	2	Average
%	67	24	9	0.4

$$\text{Price/tart} = \frac{1}{12} \left(\frac{250}{1000} \times 1.40 + \frac{125}{375} \times 4.80 + \frac{1}{6} \times 5.4 + 1 \times 3.20 + \frac{100}{375} \times 2.80 \right)$$

OR

$$\text{Cost/ingredient} = \frac{1}{12} \times (0.35 + 1.6 + 0.9 + 3.2 + 0.746\dots)$$

OR

$$\text{Cost/unit purchase} = \frac{1}{12} (250 \times 0.0014 + 125 \times 0.0128 + 1 \times 0.9 + 1 \times 3.2 + 100 \times 0.007466\dots)$$

Price/tart = \$0.57 or 57 cents

There were a variety of approaches to find the correct ratios – a common one being to find a cost/unit purchase. When students did find the correct ratio, they were not always accurate with the calculations and found a price of 58 cents.

A common incorrect method added all the individual prices and divided this figure by 12, ignoring the ‘unit’ element of the ingredients.

Question 3c.

Marks	0	1	2	Average
%	41	36	23	0.8

Median intake of fibre for a 17-year-old boy is 28 g

fibre intake for two jam tarts = $2 \times 1.3 = 2.6$ g

$$\% \text{ of daily requirement} = 9.3\% \quad \left(\frac{2.6}{28} \times 100\% \right)$$

Many solutions did not include the fibre content associated with the ‘two tarts’. Other responses inverted the two values involved $\left(\frac{28}{2.6} \right)$ or forgot to convert their calculation to a percentage value.

Question 4a.

Marks	0	1	Average
%	86	14	0.2

$$100\% - 15\% = 85\%$$

This question was not answered well. Many responses identified the 15th percentile correctly but were unable to interpret this information to provide the correct answer.

Question 4b.

Marks	0	1	2	Average
%	57	32	11	0.6

15th and the 50th

Weight is lighter than the 50th and heavier than the 15th.

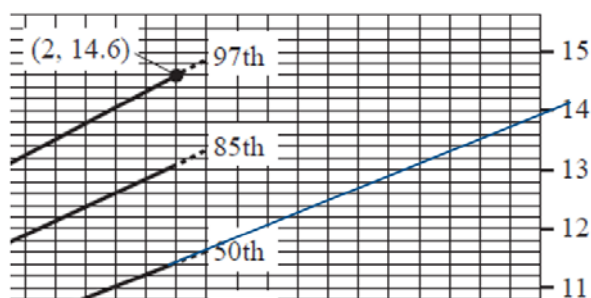
This question was not answered well. Many students correctly identified the two required percentiles but were unable to give a correct description when compared to the given weight. Some descriptions incorrectly described the 50th percentile by referring to it as 'most' or 'the majority' of weights.

Common incorrectly identified percentiles often included the 3rd and 15th.

Question 4c.i.

Marks	0	1	Average
%	63	37	0.4

Linear extrapolation starting at 50th percentile and passing through the right side of the graph



Many responses incorrectly interpreted the instruction of 'extrapolate', or included horizontal or vertical lines drawn from the end of the 50th percentile curve. Others did not extend the line to the right-hand edge of the provided graph. Many lines drawn without a ruler did not reach the right-hand section of the graph at the intended value.

Question 4c.ii.

Marks	0	1	Average
%	62	38	0.4

Predicted weight for a 3-year-old child is 13.9 kg

Students who provided an answer to question 4c.i generally received marks for this question.

Common incorrect responses listed a coordinate (3,14) as the required weight.

Question 5a.

Marks	0	1	Average
%	25	75	0.8

Traffic navigation apps

This question was answered well.

Question 5b.i.

Marks	0	1	Average
%	70	30	0.3

Facial recognition

Students often misinterpreted the instruction of 'greater than' and responded with the incorrect technology of 'smart speakers'.

Question 5b.ii.

Marks	0	1	Average
%	89	11	0.1

$$\text{Difference} = \frac{(34 - 26)}{100} \times 2500 = 200 \text{ people}$$

This question was not answered well. Students should review the technique of using a percentage to find a value. Common incorrect answers included 7% or 8% = 120.

Question 5c.

Marks	0	1	2	Average
%	46	35	19	0.8

The majority (55% or more) of responders indicated they were ‘concerned’ at the level of AI being used across various content types, which was more than any other level of concern.

An example is personalised advertising where 64% were ‘concerned’, 19% were ‘neutral’, and 14% were ‘unconcerned’. All other types showed similar statistics.

Numerous responses made statements about the graph (for example, ‘50% were concerned about job applications’) without including a comparison, or students provided their opinion on how AI would impact lives in the future. Other responses were vague and did not specifically reference information contained in the graph.

Question 6a.i.

Marks	0	1	Average
%	42	58	0.6

As there are an even number of entries in the table, the median is taken to be halfway between \$1 264 000 and \$1 318 000 and is \$1 291 000

This question was answered well.

Incorrect responses commonly calculated the mean (\$1 234 800) and not the median.

Students should take care in the presentation of their responses, ensuring they are algebraically correct.

Calculations such as $1\,264\,000 + 1\,318\,000 \div 2$ do not mathematically represent the correct answer.

Question 6a.ii.

Marks	0	1	2	Average
%	54	35	11	0.6

(answer 6a.i) – 1 220 000 = (71 000)

$$\% \text{ diff} = \frac{(71\,000)}{1\,220\,000} \times 100\% \approx 5.8\%$$

Many students were able to calculate a correct difference but were unable to identify the correct denominator. Other responses suggested that students did not recall the percentage difference rule. Students are reminded that it is on the formula sheet.

Question 6b.

Marks	0	1	2	Average
%	92	2	6	0.2

$$\frac{1\,264\,000 + 1\,234\,500 + \dots + 1\,404\,000 + 1\,355\,500 + s}{11} = 1\,300\,000$$

$$s = \$1\,952\,000$$

This question was not answered well. Many students could not correctly include the price for the 11th house. Numerous incorrect answers showed the mean price of 10 houses being subtracted from the mean price for 11 houses ($1\,300\,000 - 1\,234\,800$).

Question 7a.

Marks	0	1	2	Average
%	46	28	26	0.8

$$\text{Total paid} = \$5000 + 48 \times \$646 = \$36\,008$$

$$\text{Total interest paid} = \$36\,008 - \$29\,000 = \$7\,008$$

Students struggled to include both calculations of the deposit and total payments to find the total cost of the car. Other responses did not subtract the original cost of the car.

Question 7b.i.

Marks	0	1	2	Average
%	54	15	31	0.8

$$\begin{aligned} \text{value loss in 1 year} &= \frac{15}{100} \times 29\,000 + 0.03 \times 15\,000 \\ &= 4350 + 450 = \$4800 \end{aligned}$$

Algebraic correctness of mathematical statements is imperative for 'show that' questions. This is an area students should develop over the course of their study. Some students engaged with the question but did not clearly 'show' the intended answer. Other responses used the value to be shown rather than showing how it was developed through calculation.

Question 7b.ii.

Marks	0	1	Average
%	79	21	0.2

$$\text{Years to reach 10\% of purchase price} = \frac{29\,000 - 10\% \times 29\,000}{4800} = 5.4 \text{ yrs}$$

\Rightarrow 6 years

This question was not answered well. Some students who did answer this question correctly successfully used an iterative approach. Numerous responses showed many calculations without stating a length of time. A common incorrect response was 8 years.

Question 8a.

Marks	0	1	Average
%	61	39	0.4

$$\begin{aligned}\text{Tax income} &= 84\,000 - 2400 - 150 - 260 - 150 - (150 \times 12) \\ &= \$79\,240\end{aligned}$$

This was another 'show that' question. Many responses showed an understanding of the question but neglected to show all components. One common omission was the detail of 150×12 . Presentation of responses included 'chains' of equal signs, which lacked algebraic correctness. Some students incorrectly used 13 months as representing a year.

Question 8b.

Marks	0	1	2	Average
%	36	29	35	1.0

$$\text{Tax payable} = 5092 + ((79\,240) - 45\,000) \times 0.325 = \$16\,220$$

Where students engaged with the question, they generally identified the correct tax bracket to use.

Incorrect calculations often subtracted 45 001 rather than 45 000, used the gross pay, or omitted the required \$5092.

Question 8c.

Marks	0	1	2	Average
%	51	23	26	0.8

$$\begin{aligned}\text{Contributions} &= 52 \times \$100 + 11\% \times \$84\,000 \\ &= \$5200 + \$9240 \\ &= \$14\,440\end{aligned}$$

This question was not answered well. Many responses incorrectly used the superannuation guarantee percentage of 10% or 10.5% rather than 11%. Other responses calculated 11% of the \$5200 contribution, while others included only one component (either $52 \times \$100$ or $11\% \times \$84\,000$) as part of their calculation.

Question 9a.

Marks	0	1	Average
%	94	6	0.1

$$\begin{aligned}r &= \frac{1875}{500\,000} \times 100\% \\ &= 0.375\%\end{aligned}$$

This was another 'show that' question. Numerous responses used the value of 0.375% in the calculation rather than showing how it was calculated.

Other calculations used an incorrect denominator value taken from the table (for example, $\frac{1875}{499\,341.57}$).

Question 9b.

Marks	0	1	2	Average
%	79	14	7	0.3

Total interest in first 3 months = $1875 + 1872.53 + 1870.05 = \5617.58

Total interest in next 3 months = $1867.57 + 1865.07 + 1862.56 = \5595.20

OR

Total interest in second 3 months = $11212.78 - 617.58 = \$5595.20$

\Rightarrow Difference = $\$5617.58 - \$5595.20 = \$22.38$

Interest is calculated on a reducing balance; therefore, interest gets smaller over time.

This question was not answered well. It required students to extract the correct information from the provided stimulus material. Numerous incorrect responses used incorrect totals for the interest values or did not pay attention to the accuracy of the difference that was calculated.

In describing the reduction, many students incorrectly referenced the interest rate increasing or decreasing or mentioned how the principal value was increasing.

Question 9c.

Marks	0	1	2	Average
%	81	5	14	0.4

$$\text{Total} = \frac{0.5}{100} \times 412\,531.59 \times 12 \approx \$24\,751.90$$

This was another 'show that' question. It required students to present all the information in a correctly structured mathematical statement.

Students who did engage correctly with the question often used the method of firstly calculating the annual interest rate and then applying it to the outstanding amount.

Common incorrect responses converted 0.5% to the decimal of 0.05 or 0.5.

Question 10a.

Marks	0	1	Average
%	80	20	0.2

$$\text{Pool surface} = 25 \times 15 + \frac{1}{4}\pi \times 15^2 = 551.71\dots \approx 552 \text{ m}^2$$

This question was not answered well. Many incorrect responses calculated the area of the lap pool (rectangle) only or interpreted the quarter circle as half or a full circle in their calculations. A common incorrect answer was 375 m^2 .

Question 10b.i.

Marks	0	1	2	Average
%	88	11	1	0.2

$$V = 0.15 \times (\text{area})$$

$$\begin{aligned}
 V &= 0.15 \times \left(27.5 \times 20 + 17.5 \times 2.5 + \frac{1}{4} \pi \times 17.5^2 - 15 \times 25 - \frac{1}{4} \pi 15^2 \right) \\
 &= 42.3845 \dots \text{ m}^3 \\
 &\approx 45 \text{ m}^3
 \end{aligned}$$

This question was not answered well. Many responses did not include all components required for the path area. Other common incorrect calculations converted 15 cm to 0.015 m or 1.5 m.

Question 10b.ii.

Marks	0	1	Average
%	84	16	0.2

$$\text{Cost} = (\text{answer 10b.i}) \times 1000 \times 1.5 = (\$67\,500)$$

Many students did not attempt this question.

Students should be reminded to read ahead and identify questions that require the use of a previous calculation.

Common incorrect responses divided by 1000 and 1.5 or other combinations of these two values.

Question 10c.

Marks	0	1	Average
%	77	23	0.3

$$\begin{aligned}
 \text{Time to fill is } \frac{628\,872}{20} &= 31\,443.6 \text{ sec} \\
 &= 524.06 \text{ min} \\
 &= 8 \text{ hr } 44 \text{ min} \\
 &\Rightarrow 9 \text{ hr}
 \end{aligned}$$

Many students did not attempt this question.

Of the students who did provide a response, many incorrectly converted the values and produced answers of 524.

Question 11a.

Marks	0	1	2	Average
%	58	20	22	0.7

$$\text{Width} = 3.9 + 5.7 = 9.6 \text{ m}$$

$$\text{Length} = 3 + 4.6 + 5.5 = 13.1 \text{ m}$$

Students who engaged with this question generally answered correctly. Incorrect responses commonly included a calculation finding the area of each room in the house or writing multiple options for the required dimension values.

Question 11b.

Marks	0	1	2	Average
%	60	5	35	0.8

$$\text{Area of living room: } 3.9 \times 5.5 = 21.45 \text{ m}^2$$

$$\text{Lowest cost: } \$20 \times (21.45) = \$429$$

$$\text{Highest cost: } \$200 \times (21.45) = \$4290$$

$$\Rightarrow 429 \leq \$\text{Cost} \leq 4290$$

Students who answered this question were generally awarded the two marks. Common incorrect responses involved 20 and 200, while others involved the area of the entire house and not just the living room.

Other incorrect responses involved errors in rounding.

Question 11c.

Marks	0	1	Average
%	55	45	0.5

Cost per litre:

$$4 \text{ litre: } \frac{91.90}{4} = \$22.98/\text{L}$$

$$8 \text{ litre: } \frac{179.80}{8} = \$22.48/\text{L}$$

$$12 \text{ litre: } \frac{274.30}{12} = \$22.86/\text{L}$$

\Rightarrow 8 L tin gives the best value for money.

The students who engaged with this question correctly calculated the 8-litre tin as the best value. Some students wrote their answers in the writing space provided, and others in the table above the question. As long as the answer was clear, full marks were awarded.

Question 12a.

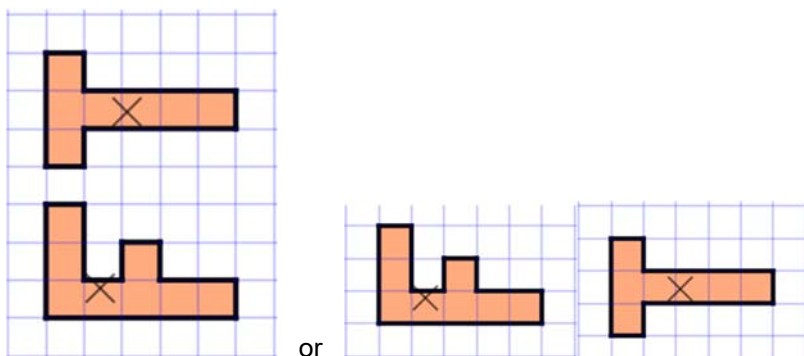
Marks	0	1	Average
%	63	37	0.4

80 cm × 50 cm × 40 cm

Common incorrect responses included $5 \times 8 \times 4$, indicating that students missed the provided scale factor. Other responses of $0.5 \times 0.8 \times 0.4$ did not include the appropriate unit. Some students simply added the dimensions together, generating the answer of 160.

Question 12b.

Marks	0	1	2	Average
%	57	19	24	0.7



Students are reminded to bring a ruler into the examination. Many students understood the rotation and resizing descriptions required for this question. Common incorrect responses rotated the shapes in the wrong direction or included too many squares in the resized images.

Question 12c.

Marks	0	1	2	Average
%	76	3	21	0.5

Volume of tank = $0.16 \times 1000 = 160$ L

Max number of fish = $\frac{160}{11.4} = 14.04$

⇒ 14 fish

Many students did not attempt this question.

Students who did engage with the question were generally awarded the two marks. Common incorrect responses used a volume other than 160 and found the number of fish to be 2000.