UNIT TEST #012 | Australian Curriculum Mathematics | UTM8T2U4

Ratio, Rates, Proportion, and Pythagoras

8 Unit Test

Free and always will be!

Instructions: Read all questions carefully to ensure you understand what is being asked. When completing your official tests / exams, your grade will be based upon your: **understanding, fluency, reasoning, and problem solving,** so ensure you show all lines of working and draw accurate, labelled diagrams where necessary. (ACiQ|9.0 Mathematics standard elaborations found on final page (general assessment marking standards)). [Practise tests are marked out of a score of 10]. For multiple choice questions, tick or fill in the circle next to the corresponding letter under the question.

Check your work if you have time. *Remember:* you don't have to start at question one, it's always best to firstly look through the test, highlight the easy looking questions and complete them first, then secondly, go back through and work on the harder questions. Good luck! And remember to breathe!

$$\sum = \frac{\quad}{10} = \quad \%$$

Part 1: Multiple Choice (2 marks)

Question 1:

a) Simplify the ratio $25 : 20$ **.**

A. 2.5 **B.** $2.5 : 1$ **C.** $5 : 4$ **D.** $4 : 5$

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for la…

b) In a right-angled triangle, if the two legs are $3\,cm$ and $4\,cm$ long, what is the length of the hypotenuse?

A. $5\,cm$ **B.** $6\,cm$ **C.** $7\,cm$ **D.** $8\,cm$

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for 1b...

Question 2:

a) If a car travels $240\,km$ in $4\,hours$, what is its average speed in km/h?

A. $30\,km/h$ **B.** $60\,km/h$ **C.** $90\,km/h$ **D.** $120\,km/h$

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for 2a...

b) Which of these statements about Pythagoras' Theorem is true in a right-angled triangle?

A. The sum of the squares of the legs equals the square of the hypotenuse.
B. The sum of the legs equals the hypotenuse.
C. The square of the legs equals the hypotenuse.
D. The hypotenuse is always the longest side.

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for 2b...

Part 2: Short Answer (4 marks)

Question 3:

a) If a recipe calls for flour, cream, and lemonade, in the ratio $4:1:1$, how much cream is needed if you have $200\,grams$ of flour? And, what is the total mass of the mixture?

b) If one leg of a right-angled triangle is $5\,units$ and the hypotenuse is $13\,units$, find the length of the other leg.

Question 4:

a) Solve the proportion $\frac{4}{3} = \frac{x}{12}$.

b) A ladder is leaning against a wall. The foot of the ladder is $6\,metres$ from the base of the wall, and the ladder reaches $8\,metres$ up the wall. How long is the ladder?

Part 3: Problem Solving (4 marks)

Question 5:

a) A map has a scale of $1\,cm$ to $5\,km$;
I. If the distance between town A and town B on the map is $4\,cm$, what is the actual distance?
II. If town B is directly north of town A , and town C is due East of town A, and you know the actual distance between town A and C is $10\,km$, what is the distance on the map between town B and C ?

b) A rectangle has dimensions $5\,cm$ by $12\,cm$. Calculate the length of the diagonal of this rectangle.

Question 6:

a) You are working in a bookstore, receiving $15 per hour as your base wage.

I. On Saturdays you receive 1.5 times this wage. If you worked $6\,hours$ each day from Tuesday to Friday, and you worked an additional $4\,hours$ on Saturday, what is your total wage for the week?

II. If you have to spend $30\,\%$ of your income on rent, how much money do you have left after paying rent for the week?

Space for Q6a…

b) A triangle has sides of $7\,cm, 24\,cm$, and $25\,cm$. Is this triangle a right-angled triangle?

Solutions

1a. (0.5 marks)

C. $5:4$.

Find the greatest common divisor (GCD) of 25 and 20, which is 5 :

$$25 \div 5 : 20 \div 5$$
$$= 5 : 4 .$$

b. (0.5 marks)

A. $5cm$.

Using Pythagoras' theorem:

$$c = \sqrt{3^2 + 4^2}$$
$$= \sqrt{9 + 16}$$
$$= \sqrt{25}$$
$$= 5\,cm .$$

2a. (0.5 marks)

B. $60\,km/h$.

$$\text{Speed} = \text{Distance} \div \text{Time}$$
$$= \frac{240\,km}{4\,h}$$
$$= 60\ km/h .$$

b. (0.5 marks)

A. The sum of the squares of the legs equals the square of the hypotenuse.

This is the correct statement of Pythagoras' Theorem.

3a. (1 mark)

Since the ratio is $4:1:1$, for every 4 parts flour, there's 1 part cream.

Cream needed:

$$\rightarrow \frac{1}{4} \times 200$$
$$= \frac{200}{4}$$
$$= \left(\frac{20}{4}\right) 0$$
$$= 50\,grams.$$

If we have $200\,grams$ of flour, and we need $50\,grams$ of cream,
This means we also need $50\,grams$ of lemonade,
(the ratio of cream to lemonade is the same, i.e. $1:1$),
so the total amount of mixture is $200 + 50 + 50$
$= 300\,grams.$

b. (1 mark)

Using Pythagoras' theorem where $a^2 + b^2 = c^2$:

$$5^2 + b^2 = 13^2$$
$$25 + b^2 = 169$$
$$25 - 25 + b^2 = 169 \quad -25$$
$$b^2 = 144$$
$$\sqrt{b^2} = \sqrt{144}$$
$$b = \sqrt{144}$$
$$b = \sqrt{12^2}$$
$$b = \sqrt{12^2}$$
$$= 12\,units.$$

The length of the other leg is $12\,units$.

Why does $\sqrt{}$ cancel ^{2} ? :

$$\sqrt{x^2} = (x^2)^{\frac{1}{2}}$$
$$= x^{2\times\frac{1}{2}}$$
$$= x^{\frac{2\times 1}{2}}$$
$$= x^{\frac{2}{2}}$$

Thus, $\sqrt{x^2} = x^1 \equiv x$.

$\equiv$ means, 'the same as' or 'equivalent'.

4a. (1 mark)

$$\frac{4}{3} = \frac{x}{12}$$

Cross multiply:

$$4 \times 12 = 3 \times x$$
$$48 = 3x$$
$$x = \frac{48}{3}$$
$$x = 16.$$

b. (1 mark)

Using Pythagoras' theorem:

$$\begin{aligned} c^2 &= a^2 + b^2 \\ \sqrt{c^2} &= \sqrt{a^2 + b^2} \\ c &= \sqrt{a^2 + b^2} \\ &= \sqrt{6^2 + 8^2} \\ &= \sqrt{36 + 64} \\ &= \sqrt{100} \\ &= \sqrt{10^2} \\ &= 10\,m\,. \end{aligned}$$

The ladder is 10 metres long.

5a. (1 mark)

I.

Using the scale:

$$\begin{aligned} 1\,cm &: 5\,km \\ 1\,cm \times 4 &: 5 \times 4 \\ \rightarrow 4\,cm &: 20\,km\,. \end{aligned}$$

So $4\,cm$ on the map $= 20\,km$ in real life.

II.

This makes a right angled triangle with side lengths $10\,km$ and $20\,km$, which on the map is $2\,cm$ and $4\,cm$, ($4\,cm = 20\,km$ so $2\,cm = 10\,km$). We use Pythagoras to find the length of the hypotenuse:

$$\begin{aligned} a^2 + b^2 &= c^2 \\ 2^2 + 4^2 &= c^2 \\ 4 + 16 &= c^2 \\ 20 &= c^2 \\ c^2 &= 20 \\ \sqrt{c^2} &= \sqrt{20} \\ c &= \sqrt{20} \\ c &\approx 4.47\,cm\,. \end{aligned}$$

So the distance on the map, between town B and town C is $4.47\,cm$.

b. (1 mark)

The diagonal of a rectangle forms the hypotenuse of a right-angled triangle with the sides as legs:

$$c^2 = a^2 + b^2$$
$$\sqrt{c^2} = \sqrt{a^2 + b^2}$$
$$c = \sqrt{a^2 + b^2}$$
$$\text{Diagonal} = \sqrt{5^2 + 12^2}$$
$$= \sqrt{25 + 144}$$
$$= \sqrt{169}$$
$$= \sqrt{13^2}$$
$$= 13\,cm\,.$$

The diagonal is $13\,cm$.

6a. (1 mark)

I. Firstly, determine how much you earn from Tuesday to Friday:

Pay rate : $\$15$ per hour ,
$6\,hours$ of work each day ,

$$\text{Pay} = \$15 / \cancel{\text{hour}} \times 6\,\cancel{hours}$$
$$= \$90 \text{ earned each day ,}$$

Tuesday to Friday is $4\,days$,
Pay from Tuesday to Friday :
$$= \$90 \times 4$$
$$= \$360\,,$$

Then determine your pay on Saturdays :
$$= 1.5 \times \$15$$
$$= \$22.50\,per\,hour$$
$$\text{Pay} = \$22.50 / \cancel{\text{hour}} \times 4\,\cancel{hours}$$
$$= \$90$$

Weekly wage :
$$= \$360 + \$90$$
$$= \$450\,.$$

II.

$$\text{Weekly wage} = \$450$$
$$\text{Part of income that goes to rent} = 30\,\%$$

Firstly find how much money to pay for rent:

$$\begin{aligned}\text{Rent} &= 30\,\% \text{ of } \$450 \\ &= \frac{30}{100} \times 450 \\ &= 0.3 \times \$450 \\ &= \$135\,,\end{aligned}$$

Now determine how much money is left after paying rent:

$$\begin{aligned}\text{Money left} &= \$450 - \$135 \\ &= \$315\,.\end{aligned}$$

b. (1 mark)

Using: $a^2 + b^2 = c^2$

Check if Left Hand Side equals Right Hand Side:

$$\begin{aligned}\text{LHS} = 7^2 + 24^2 &= 25^2 : \\ 49 + 576 &= 625\,.\end{aligned}$$

$$\text{RHS} = 625\,.$$

Since LHS $\equiv$ RHS $\equiv$ means, 'the same as' or 'equivalent'.

$$625 \equiv 625\,,$$

Therefore this triangle is a right-angled triangle.

$$\sum = \frac{}{10} = \quad \%$$

General Assessment Marking Standards

Remember: When your official tests are marked, they won't be a score out of 10, they will be a grade (A,B,C,D,E) based on the following standards:

ACiQ | v9.0

Year 8 Mathematics standard elaborations

		A	B	C	D	E
		The folio of student work contains evidence of the following:				
Mathematical proficiencies	Understanding	accurate and consistent identification, representation, description and connection of mathematical concepts and relationships in complex unfamiliar, complex familiar, and simple familiar situations	accurate identification, representation, description and connection of mathematical concepts and relationships in complex familiar and simple familiar situations	identification, representation, description and connection of mathematical concepts and relationships in simple familiar situations	partial identification, representation and description of mathematical concepts and relationships in some simple familiar situations	fragmented identification, representation and description of mathematical concepts and relationships in isolated and obvious situations
	Fluency	choice, use and application of comprehensive facts, definitions, and procedures to find solutions in complex unfamiliar, complex familiar, and simple familiar situations	choice, use and application of effective facts, definitions, and procedures to find solutions in complex familiar and simple familiar situations	choice, use and application of facts, definitions, and procedures to find solutions in simple familiar situations	choice and use of partial facts, definitions, and procedures to find solutions in some simple familiar situations	choice and use of fragmented facts, definitions and procedures to find solutions in isolated and obvious situations
	Reasoning	comprehensive explanation of mathematical thinking, strategies used, and conclusions reached in complex unfamiliar, complex familiar, and simple familiar situations	detailed explanation of mathematical thinking, strategies used, and conclusions reached in complex familiar and simple familiar situations	explanation of mathematical thinking, strategies used, and conclusions reached in simple familiar situations	partial explanation of mathematical thinking, strategies used, and conclusions reached in some simple familiar situations	fragmented explanation of mathematical thinking, strategies used, and conclusions reached in isolated and obvious situations
	Problem-solving	purposeful use of problem-solving approaches to find solutions to problems.	effective use of problem-solving approaches to find solutions to problems.	use of problem-solving approaches to find solutions to problems.	partial use of problem-solving approaches to make progress towards finding solutions to problems.	fragmented use of problem-solving approaches to make progress towards finding solutions to problems.

Key shading emphasises the qualities that discriminate between the A–E descriptors

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