μNIT TEST #9-1A | Australian Curriculum Mathematics | February 2025

Real Numbers

9 μnit Test

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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.

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

Part 1: Multiple Choice (2 marks)

Question 1:

Which of the following numbers is irrational?

A. $\frac{3}{4}$ **B.** $\sqrt{4}$ **C.** π **D.** $0.333...$

○ A ○ B ○ C ○ D

Space for question 1…

Question 2:

What is the simplest form of $\sqrt{48}$?

A. $4\sqrt{3}$ **B.** $8\sqrt{6}$ **C.** $6\sqrt{2}$ **D.** $2\sqrt{12}$

○ A ○ B ○ C ○ D

Space for question 2…

Part 2: Short Answer (4 marks)

Question 3:

Explain why $\sqrt{15}$ is an irrational number.

Question 4:

Simplify the expression $\sqrt{75} - \sqrt{48}$ **.**

Part 3: Problem Solving (4 marks)

Question 5:

A rectangle has sides of length $\sqrt{8}\,cm$ **and** $\sqrt{18}\,cm$ **. Find the area of the rectangle in simplest surd form.**

Question 6:

Given that $a = \sqrt{7} + \sqrt{3}$, show that a is irrational.

Solutions

1. (1 mark)

C. π

Pi is not expressible as a fraction and its decimal does not terminate or repeat, making it irrational.

2. (1 mark)

A. $4\sqrt{3}$

Factorise 48 as : $16 \times 3 = 2^4 \times 3$, so :

$$\begin{aligned}\sqrt{48} &= \sqrt{2^4 \times 3} \\ &= \sqrt{16 \times 3} \\ &= \sqrt{16} \times \sqrt{3} \\ &= 4\sqrt{3}\,.\end{aligned}$$

3. (2 marks)

$\sqrt{15}$ is irrational because 15 is not a perfect square,
meaning there's no integer whose square is 15 .

Thus, $\sqrt{15}$ cannot be expressed as a simple fraction;
its decimal expansion goes on infinitely without repeating.

4. (2 marks)

First, simplify each term:

$$\begin{aligned}\sqrt{75} &= \sqrt{25 \times 3} \\ &= \sqrt{25} \times \sqrt{3} \\ &= 5\sqrt{3}\,,\end{aligned}$$

$$\begin{aligned}\sqrt{48} &= \sqrt{16 \times 3} \\ &= \sqrt{16} \times \sqrt{3} \\ &= 4\sqrt{3}\,,\end{aligned}$$

Then subtract:

$$\begin{aligned}\sqrt{75} - \sqrt{48} &= 5\sqrt{3} - 4\sqrt{3} \\ &= 1\sqrt{3} \\ &= \sqrt{3}\,.\end{aligned}$$

5. (2 marks)

Simplify the side lengths:

$$\sqrt{8} = \sqrt{4 \times 2}$$
$$= 2\sqrt{2},$$
$$\sqrt{18} = \sqrt{9 \times 2}$$
$$= 3\sqrt{2}.$$

Area $=$ length $\times$ width :

$$\text{Area} = 2\sqrt{2} \times 3\sqrt{2}$$
$$= 2 \times 3 \times \sqrt{2} \times \sqrt{2}$$
$$= 6 \times \sqrt{2 \times 2}$$
$$= 6 \times \sqrt{4}$$
$$= 6 \times 2$$
$$= 12\,cm^2.$$

6. (2 marks)

Assume for contradiction that a is rational,

then $a = \frac{p}{q}$ where p and q are integers with no common factors other than 1 .

$$a = \sqrt{7} + \sqrt{3}$$

Squaring both sides :

$$a^2 = (\sqrt{7} + \sqrt{3})^2$$

$$= (\sqrt{7} + \sqrt{3}) \times (\sqrt{7} + \sqrt{3})$$ Use Crab Claw

$$= \sqrt{7} \cdot \sqrt{7} + \sqrt{7} \cdot \sqrt{3} + \sqrt{3} \cdot \sqrt{7} + \sqrt{3} \cdot \sqrt{3}$$
$$= 7 + \sqrt{7} \cdot \sqrt{3} + \sqrt{3} \cdot \sqrt{7} + 3$$
$$= 7 + \sqrt{7 \cdot 3} + \sqrt{3 \cdot 7} + 3$$
$$= 7 + \sqrt{21} + \sqrt{21} + 3$$
$$= 7 + 1\sqrt{21} + 1\sqrt{21} + 3$$
$$= 7 + 2\sqrt{21} + 3$$
$$a^2 = 10 + 2\sqrt{21} .$$

$$(\sqrt{7} + \sqrt{3})^2 = 10 + 2\sqrt{21} .$$

If a^2 is rational, remember $a = \frac{p}{q} \rightarrow a^2 = \frac{p^2}{q^2} \left[= \left(\frac{p}{q} \right)^2 \right]$, then :

$10 + 2\sqrt{21}$ must be rational, and as 10 is rational, and as $2 \times$ maintains rationality, this implies $\sqrt{21}$ is rational, which is a contradiction since $\sqrt{21}$ is known to be irrational, (as 21 is not a perfect square).

Therefore, a must be irrational.

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Indices and Surds

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Part 1: Multiple Choice (2 marks)

Question 1:

Simplify the expression $2^3 \times 2^5$ **.**

A. 2^{15} **B.** 2^8 **C.** 4^8 **D.** 2^{13}

◯ A ◯ B ◯ C ◯ D

Space for question 1…

Question 2:

Which of the following is the simplest form of $\sqrt{50}$?

A. $5\sqrt{2}$ **B.** $25\sqrt{2}$ **C.** $10\sqrt{5}$ **D.** $2\sqrt{25}$

◯ A ◯ B ◯ C ◯ D

Space for question 2…

Part 2: Short Answer (4 marks)

Question 3:

Simplify the following expressions using index laws:

a) $5^4 \div 5^2 \equiv \frac{5^4}{5^2}$

b) $(3^2)^3$

Question 4:

Simplify $\sqrt{72} + \sqrt{18}$ and express the answer in simplest surd form.

Part 3: Problem Solving (4 marks)

Question 5:

a) Simplify $\frac{4x^5 \times 2x^3}{8x^2}$ using index laws.

b) Rationalise the denominator of $\frac{3}{\sqrt{5}}$.

Question 6:

A square has an area of $48\,cm^2$.

a) Express the side length as a surd in simplest form.

b) If the side length is doubled, find the new area and simplify the result.

Solutions

1. (1 mark)

B. 2^8.

Using the index law: $a^m \times a^n = a^{m+n}$,

$$2^3 \times 2^5 = 2^{3+5} = 2^8.$$

2. (1 mark)

A. $5\sqrt{2}$.

Factorise 50 as 25×2, so :

$$\sqrt{50} = \sqrt{25 \times 2} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}.$$

3a. (2 marks)

$$5^4 \div 5^2 = 5^{4-2} = 5^2 = 25.$$

Using : $a^m \div a^n = a^{m-n}$.

b. (1 mark)

$$(3^2)^3 = 3^{2\times3} = 3^6 = 729.$$

Using : $(a^m)^n = a^{m\times n}$.

4. (2 marks)

$$\sqrt{72} + \sqrt{18}$$

$$\begin{aligned}\sqrt{72} &= \sqrt{36 \times 2} \\ &= \sqrt{36} \times \sqrt{2} \\ &= 6\sqrt{2},\end{aligned}$$

$$\begin{aligned}\sqrt{18} &= \sqrt{9 \times 2} \\ &= \sqrt{9} \times \sqrt{2} \\ &= 3\sqrt{2},\end{aligned}$$

$$\begin{aligned}\sqrt{72} + \sqrt{18} &= 6\sqrt{2} + 3\sqrt{2} \\ &= 9\sqrt{2}.\end{aligned}$$

5a. (1 mark)

$$\frac{4x^5 \times 2x^3}{8x^2}$$

Numerator:

$$\begin{aligned}4x^5 \times 2x^3 &= (4 \times 2) \times x^{5+3} \\ &= 8x^{5+3} \\ &= 8x^8,\end{aligned}$$

Divide :

$$\begin{aligned}\frac{8x^8}{8x^2} &= \frac{8}{8} \times x^{8-2} \\ &= 1 \times x^6 \\ &= x^6.\end{aligned}$$

b. (1 mark)

Multiply by $\frac{\sqrt{5}}{\sqrt{5}}$:

$$\frac{3}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{3 \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}}$$
$$= \frac{3\sqrt{5}}{\sqrt{5 \times 5}}$$
$$= \frac{3\sqrt{5}}{\sqrt{25}}$$
$$= \frac{3\sqrt{5}}{5}.$$

6a. (1 mark)

Area $\rightarrow s^2 = 48$,

$$\sqrt{s^2} = \sqrt{48}$$
$$s = \sqrt{48}$$
$$= \sqrt{16 \times 3}$$
$$= \sqrt{16} \times \sqrt{3}$$
$$= 4\sqrt{3}\,cm.$$

b. (1 mark)

New side length $S = 2 \times 4\sqrt{3}$

$$S = 8\sqrt{3}\,cm,$$

New area $= S^2$

$$= (8\sqrt{3})^2$$
$$= 8^2 \times \left(\sqrt{3}\right)^2$$
$$= 8^2 \times \left(\sqrt{3}\right)^2$$
$$= 64 \times 3$$
$$= 192\,cm^2.$$

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

Algebraic Techniques

9

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Part 1: Multiple Choice (2 marks)

Question 1:

Which operation would you perform first in simplifying $3x + 2(5x - 7)$ **?**

A. Multiply 2 **by** $5x$
B. Subtract 7 **from** $5x$
C. Add $3x$ **and** 2
D. Distribute 2 **to both terms inside the parentheses**

○ A ○ B ○ C ○ D

Space for question 1…

Question 2:

What is the solution to the equation $2x - 5 = 7$ **?**

A. $x = 1$ **B.** $x = 6$ **C.** $x = 11$ **D.** $x = 12$

○ A ○ B ○ C ○ D

Space for question 2…

Part 2: Short Answer (4 marks)

Question 3:

Expand and simplify $(x - 3)(x + 3)$ **.**

Question 4:

Factorise the polynomial $x^2 + 6x + 8$.

Part 3: Problem Solving (4 marks)

Question 5:

Solve the equation $3x^2 - 12x = 0$ by factoring.

Question 6:

Simplify the expression $\dfrac{2x^2 + 5x - 3}{x + 3}$ **by factorising the numerator.**

Solutions

1. (1 mark)

D. Distribute 2 to both terms inside the parentheses.

According to the order of operations, you distribute before adding.

2. (1 mark)

B. $x = 6$.

Solving for x :

$$2x - 5 = 7$$
$$2x \cancel{-5} \cancel{+5} = 7 + 5$$
$$2x = 12$$
$$\frac{\cancel{2}x}{\cancel{2}} = \frac{12}{2}$$
$$x = 6.$$

3. (2 marks)

Using the difference of squares formula:

Rule for difference of two squares:

$$a^2 - b^2 = (a+b)(a-b)$$
$$(a+b)(a-b) = a^2 - b^2$$

$$(x-3)(x+3) = x^2 - 3^2$$
$$= x^2 - 9.$$

4. (2 marks)

Find two numbers that multiply to 8 and add to 6 :

$$x^2 + 6x + 8 = (x+2)(x+4).$$

5. (2 marks)

$$3x^2 - 12x = 0$$
$$3x \times x - 3x \times 4 = 0$$
$$3x \times x - 3x \times 4 = 0$$
$$3x \times (x - 4) = 0$$

Factor out the common factor:

$$3x(x - 4) = 0$$

$$\Rightarrow 3x(x - 4) = 0$$
$$\frac{\cancel{3x}(x - 4)}{\cancel{3x}} = \frac{0}{3x}$$
$$x - 4 = 0$$
$$x \cancel{-4} \cancel{+4} = 0 + 4$$
$$x = 4,$$

AND

$$\Rightarrow 3x(x - 4) = 0$$
$$\frac{3x\cancel{(x - 4)}}{\cancel{(x - 4)}} = \frac{0}{(x - 4)}$$
$$3x = 0$$
$$\frac{\cancel{3}x}{\cancel{3}} = \frac{0}{3}$$
$$x = 0.$$

So, $x = 0$ and $x = 4$.

6. (2 marks)

$$\frac{2x^2+5x-3}{x+3}$$

Numerator:

$$2x^2+5x-3$$
$$2x^2+5x-3$$

We need numbers that multiply to give $(2\times -3)=-6$ and add to $+5$:

These numbers are 6 and -1 ,

so we break $5x$ into $6x - 1x = 6x - x$,

$$\begin{aligned}
&\rightarrow 2x^2+5x-3\\
&=2x^2+6x-x-3\\
&=x\times 2x+x\times 6-1\times x-1\times 3\\
&=2x\times x+2x\times 3-1\times x-1\times 3\\
&=2x\times x+2x\times 3-1\times x-1\times +3\\
&=2x(x+3)-1(x+3)\\
&=(2x-1)(x+3)\,.
\end{aligned}$$

So, $$\frac{2x^2+5x-3}{x+3}\Rightarrow\frac{(2x-1)(x+3)}{x+3}$$
$$=\frac{(2x-1)\cancel{(x+3)}}{\cancel{(x+3)}}$$
$$=2x-1\,.$$

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

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:

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Year 9 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