

1234 Year 9 QLD Mathematics: Number and Algebra Exercise Set

1. Real Numbers

1. Classify the following numbers as **Rational** (Q) or **Irrational** (I): a) $\sqrt{25}$ b) π c) $0.3333\dots$ d) $0.121121112\dots$ e) $-\frac{7}{2}$
 2. Express the number 4,320,000 in **scientific notation**.
 3. Write the number 8.05×10^{-4} in **standard notation**.
 4. A map has a ratio scale of 1 : 50,000. If a park is 6 cm wide on the map, what is its actual width in kilometres?
 5. Simplify the expression: $3\sqrt{5} + 2\sqrt{20} - \sqrt{45}$.
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2. Indices and Exponents

1. Simplify the expression: $m^5 \times m^3 \div m^2$.
2. Evaluate: $(2x^3)^4$.
3. Simplify and write with **positive indices** only: $\frac{18p^5q^{-2}}{6p^2q^3}$.
4. Evaluate: $7^0 + 4^{-2}$.
5. Solve for x : $3^x = \frac{1}{81}$.

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3. Financial Mathematics

Note: Use the simple interest formula $I = PRT$, where I is interest, P is principal, R is annual rate (as a decimal), and T is time in years.

1. Calculate the **simple interest** earned on a principal of \$5,000 at an annual rate of 4% for 3 years.
2. What is the **total value** of the investment from Question 1 after 3 years?
3. A loan of \$12,000 incurs \$1,440 in simple interest over 2 years. What was the **annual interest rate**?
4. Chloe borrows \$800 at a simple interest rate of 6% per annum. How long, in years, will it take for her to owe a total of \$896?

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5. A television originally priced at \$1,500 is discounted by 20%. What is the **sale price** of the television?
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4. Algebraic Techniques

1. Expand and simplify: $3(2x - 5) - 4(x + 1)$.
 2. Expand the binomial product: $(x + 7)(x - 3)$.
 3. Factorise the monic quadratic expression: $x^2 + 10x + 24$.
 4. Factorise the expression fully: $4y^2 - 16y$.
 5. Simplify the algebraic fraction: $\frac{a^2 - 4}{a + 2}$.
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5. Linear and Non-linear Relations

1. Calculate the **gradient** (slope) of the line segment connecting the points $A(-4, 6)$ and $B(2, 3)$.
2. Find the **midpoint** of the line segment connecting the points $P(1, -5)$ and $Q(7, 1)$.
3. Determine the **distance** between the points $C(0, 5)$ and $D(4, 2)$ using the distance formula.
4. A non-linear relationship is given by the equation $y = x^2 - 4$. Find the value of y when $x = -3$.
5. Sketch the linear relation $y = -2x + 4$ by finding the x - and y -intercepts.

✓ Answers

1. Real Numbers

1. a) $\mathbb{Q}$ ($\sqrt{25} = 5$) b) $\mathbb{I}$ c) $\mathbb{Q}$ ($0.3333... = \frac{1}{3}$) d) $\mathbb{I}$ (non-repeating, non-terminating decimal) e) $\mathbb{Q}$
2. 4.32×10^6
3. 0.000805
4. 3 km (Actual distance = $6 \text{ cm} \times 50,000 = 300,000 \text{ cm} = 3,000 \text{ m} = 3 \text{ km}$)
5. $4\sqrt{5}$ (Hint : $2\sqrt{20} = 2\sqrt{4 \times 5} = 4\sqrt{5}$ and $\sqrt{45} = \sqrt{9 \times 5} = 3\sqrt{5}$. So, $3\sqrt{5} + 4\sqrt{5} - 3\sqrt{5} = 4\sqrt{5}$)

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2. Indices and Exponents

1. m^6 (Hint : $m^{5+3-2} = m^6$)
2. $16x^{12}$
3. $\frac{3p^3}{q^5}$ (Hint : $\frac{18}{6} = 3$, $p^{5-2} = p^3$, $q^{-2-3} = q^{-5} = \frac{1}{q^5}$)
4. $1\frac{1}{16}$ or $\frac{17}{16}$ (Hint : $7^0 = 1$ and $4^{-2} = \frac{1}{4^2} = \frac{1}{16}$)
5. $x = -4$ (Hint : $\frac{1}{81} = 3^{-4}$)

3. Financial Mathematics

1. \$600 ($I = 5000 \times 0.04 \times 3$)
2. \$5,600 (Total = Principal + Interest = $5000 + 600$)
3. 6% ($R = \frac{I}{PT} = \frac{1440}{12000 \times 2} = 0.06$)
4. 2 years (Interest earned = $896 - 800 = 96$. $T = \frac{I}{PR} = \frac{96}{800 \times 0.06} = 2$)
5. \$1,200 (Discount amount = $1500 \times 0.20 = 300$. Sale Price = $1500 - 300$)

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4. Algebraic Techniques

1. $2x - 19$ (Hint : $6x - 15 - 4x - 4$)
2. $x^2 + 4x - 21$
3. $(x + 6)(x + 4)$
4. $4y(y - 4)$
5. $a - 2$ (Hint : $a^2 - 4$ is a Difference of Perfect Squares: $(a - 2)(a + 2)$)

5. Linear and Non-linear Relations

1. Gradient $m = -\frac{1}{2}$ (Hint : $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 6}{2 - (-4)} = \frac{-3}{6}$)
2. Midpoint $(4, -2)$ (Hint : Midpoint = $(\frac{1+7}{2}, \frac{-5+1}{2})$)
3. Distance $d = 5$ units (Hint : $d = \sqrt{(4 - 0)^2 + (2 - 5)^2} = \sqrt{16 + 9} = \sqrt{25}$)
4. $y = 5$ (Hint : $y = (-3)^2 - 4 = 9 - 4$)
5. y -intercept is $(0, 4)$; x -intercept is $(2, 0)$. The sketch is a straight line passing through these two points.

You might find this video useful for reviewing the concepts of graphing linear and non-linear relationships: [How to Learn Linear and Non Linear Relationships Grade 9 Academic Lesson 2 5](#).