Here is a set of exercises covering the core "Number and Algebra" topics for Year 8 in Queensland, along with the answers.

🔢 Year 8 Mathematics: Number and Algebra Exercise

A. Real Numbers

1. Identify which of the following numbers are **irrational**: $\frac{1}{3}, \sqrt{9}, 0.75, \pi, \sqrt{10}$.
2. Convert the recurring decimal $0.\overline{4}$ into a **fraction** in its simplest form.
3. Place the following numbers in ascending order: $-1.5, \sqrt{4}, 0.\overline{3}, \frac{1}{2}, -\sqrt{9}$.
4. State whether $\sqrt{16}$ is a **rational** or **irrational** number, and explain why.
5. Between which two consecutive integers does $\sqrt{40}$ lie?

B. Integers and Rational Numbers

1. Calculate: $-12 + 5 - (-8)$.
2. Calculate: $-4 \times (-3) \times (-5)$.
3. Calculate: $\frac{2}{5} - \frac{1}{3}$.
4. A submarine is $150\ \text{m}$ below sea level. It rises $45\ \text{m}$ and then dives $70\ \text{m}$. What is its final depth?
5. Calculate the value of $-\frac{3}{4} \div \frac{9}{8}$.

C. Index Laws

1. Simplify: $a^4 \times a^7$.
2. Simplify: $\frac{x^{12}}{x^3}$.
3. Simplify: $(2y^3)^4$.
4. Simplify: $b^5 \times b \div b^2$.
5. Write $250,000$ in **scientific notation**.

D. Financial Mathematics

1. A shirt is priced at $\$60$. If a discount of 15% is offered, what is the new price?
2. What is the **selling price** of an item that costs the retailer $\$80$ to buy, if the retailer adds a $\mathbf{30\%}$ mark-up (profit)?
3. Simplify the ratio $45 \text{ minutes} : 2 \text{ hours}$.
4. In a class, the ratio of boys to girls is $3 : 5$. If there are 32 students in total, how many girls are there?
5. A family pays $\$5.00$ in GST (Goods and Services Tax) on a purchase. If the GST is $\mathbf{10\%}$ of the original price, what was the original price of the purchase (excluding GST)?

E. Algebraic Expressions

1. Simplify the expression: $5x + 3y - 2x + y$.
2. **Expand** the expression: $4(2a - 5)$.
3. **Factorise** the expression: $6m + 9$.
4. Evaluate the expression $3p^2 - 4q$ when $\mathbf{p = 3}$ and $\mathbf{q = -2}$.
5. Expand and simplify: $3(x + 2) + 2(4x - 1)$.

F. Linear Equations and Inequalities

1. Solve the equation for x: $3x - 7 = 11$.
2. Solve the equation for y: $\frac{y}{4} + 5 = 2$.
3. Solve the inequality and graph the solution on a number line: $2x - 3 > 5$.
4. Solve the equation: $5(k - 2) = 2k + 8$.
5. The sum of three consecutive integers is 75. Find the smallest integer.

Next

G. Linear Relations

1. State the y-**intercept** of the linear equation $y = 3x - 4$.
2. What is the **gradient (slope)** of the line $y = -2x + 5$?
3. Does the point $(3, 1)$ lie on the line $y = 4x - 11$? Show your working.
4. Find the equation of a line with a **gradient of 2** that passes through the y-**intercept of 5**.
5. A line passes through the points $(1, 6)$ and $(3, 10)$. Calculate the **gradient** of the line.

✅ Answers

A. Real Numbers

1. $\pi, \sqrt{10}$
2. $\frac{4}{9}$
3. $-\sqrt{9}, -1.5, 0.\overline{3}, \frac{1}{2}, \sqrt{4}$ (or $-3, -1.5, \frac{1}{3}, 0.5, 2$)
4. **Rational** number. Explanation: $\sqrt{16} = 4$, which can be written as the fraction $\frac{4}{1}$.
5. 6 and 7 (since $6^2 = 36$ and $7^2 = 49$)

B. Integers and Rational Numbers

1. 1 (Working: $-12 + 5 - (-8) = -7 + 8 = 1$)
2. -60
3. $\frac{1}{15}$ (Working: $\frac{6}{15} - \frac{5}{15} = \frac{1}{15}$)
4. $175\ \text{m}$ below sea level (Working: $-150 + 45 - 70 = -105 - 70 = -175$)
5. $-\frac{2}{3}$ (Working: $-\frac{3}{4} \times \frac{8}{9} = -\frac{24}{36} = -\frac{2}{3}$)

next

C. Index Laws

1. a^{11}
2. x^{9}
3. $16y^{12}$
4. b^{4}
5. 2.5×10^{5}

D. Financial Mathematics

1. $\$51.00$ (Working: 15% of $\$60 = 0.15 \times 60 = 9$; $\$60 - 9 = \$51$)
2. $\$104.00$ (Working: 30% of $\$80 = 0.30 \times 80 = 24$; $\$80 + 24 = \$104$)
3. $3 : 8$ (Working: $2 \text{ hours} = 120 \text{ minutes}$. $45 : 120 \rightarrow 9 : 24 \rightarrow 3 : 8$)
4. 20 girls (Working: Total parts $= 3 + 5 = 8$. Girls' fraction is $\frac{5}{8}$. $\frac{5}{8} \times 32 = 20$)
5. $\$50.00$

E. Algebraic Expressions

1. $3x + 4y$
2. $8a - 20$
3. $3(2m + 3)$
4. 35 (Working: $3(3)^2 - 4(-2) = 3(9) + 8 = 27 + 8 = 35$)
5. $11x + 4$ (Working: $3x + 6 + 8x - 2 = 11x + 4$)

next

F. Linear Equations and Inequalities

1. $x = 6$
2. $y = -12$
3. $x > 4$. (Graphing requires a number line with an **open circle** at 4 and an arrow pointing to the right.)
4. $k = 6$ (Working: $5k - 10 = 2k + 8 \rightarrow 3k = 18 \rightarrow k = 6$)
5. 24 (Working: Let the smallest integer be n. $n + (n + 1) + (n + 2) = 75 \rightarrow 3n + 3 = 75 \rightarrow 3n = 72 \rightarrow n = 24$)

G. Linear Relations

1. -4 (The y-intercept is $(0, -4)$)
2. -2
3. **Yes**. (Working: Substitute $x = 3$ into the equation: $y = 4(3) - 11 = 12 - 11 = 1$. Since $y = 1$, the point $(3, 1)$ is on the line.)
4. $y = 2x + 5$
5. 2 (Working: Gradient $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 6}{3 - 1} = \frac{4}{2} = 2$)