Worked solutions | Algebra

Variables, formulas and substitution

8 questions | 27 marks

Equivalent correct methods and notation earn corresponding marks. Include units and directions where asked. Each worked step identifies the mark allocation.

1. A museum charges 6 dollars per ticket plus one booking fee of 4 dollars. The formula is $C = 6n + 4$, where C is the total cost in dollars. State what n represents, give the coefficient of n, and explain what the constant term represents. [3 marks]

The repeated charge is 6 dollars for each ticket, so n counts tickets. (1 mark)

The number multiplying n is its coefficient, 6. (1 mark)

The term 4 adds one booking fee regardless of the number of tickets. (1 mark)

Answer: n is the number of tickets; its coefficient is 6; the constant 4 is the single booking fee in dollars.

2. Rewrite $5a$, ab and $3(b + 2)$ using multiplication signs. Then evaluate ab when $a = 2$ and $b = 4$. [4 marks]

$5a = 5 \times a$. (1 mark)

$ab = a \times b$. (1 mark)

$3(b + 2) = 3 \times (b + 2)$. Keep the whole bracket together. (1 mark)

Substitute both values: $ab = 2 \times 4 = 8$. (1 mark)

Answer: $5 \times a$, $a \times b$, $3 \times (b + 2)$; $ab = 8$.

3. When $u = 3$ and $v = 5$, evaluate [4 marks]

(a) $3u + v$

(b) $u + u + v$. Show each substitution. Are the results equal?

(a) Replace both variables: $3u + v = 3 \times 3 + 5$. (1 mark)

Calculate $9 + 5 = 14$. (1 mark)

(b) Replace every occurrence: $u + u + v = 3 + 3 + 5$. (1 mark)

Calculate 11. Since $14 \neq 11$, the results are different. (1 mark)

Answer:

(a) 14

(b) 11. The results are different.

4. Evaluate $4(p + 2)$ when $p = 3$. Leo instead calculates $4 \times 3 + 2 = 14$. Explain why his method does not match the expression. [3 marks]

Substitute while retaining brackets: $4(p + 2) = 4(3 + 2)$. (1 mark)

Calculate the bracket, then multiply: $4 \times 5 = 20$. (1 mark)

The 4 multiplies the whole sum $p + 2$. Leo's calculation multiplies only p by 4. (1 mark)

Answer: 20. Leo has not multiplied the whole bracket by 4.

5. Evaluate $s^2 + 2s$ when $s = 5$. Show the values of s^2 and $2s$ separately before adding them. [3 marks]

Square the value: $s^2 = 5^2 = 5 \times 5 = 25$. (1 mark)

Double the value: $2s = 2 \times 5 = 10$. (1 mark)

Add: $s^2 + 2s = 25 + 10 = 35$. (1 mark)

Answer: $s^2 = 25$, $2s = 10$, so $s^2 + 2s = 35$.

6. Three seedlings have heights a, b and c, all in centimetres. Their mean height is given by $m = \frac{a+b+c}{3}$. Find m when $a = 12$, $b = 15$ and $c = 18$. Explain why you add before dividing. [3 marks]

Replace the heights: $m = \frac{12+15+18}{3}$. (1 mark)

Add the numerator, then divide: $m = \frac{45}{3} = 15$ cm. (1 mark)

The fraction bar means divide the whole sum $a + b + c$ by 3, so that sum must be calculated first. (1 mark)

Answer: The mean height is 15 cm. The fraction bar groups the entire sum in the numerator.

7. A rectangular label has length $l = 9$ cm and width $w = 4$ cm. Use $P = 2l + 2w$ to find its perimeter. State the unit and check your answer by adding its four side lengths. [3 marks]

Substitute: $P = 2 \times 9 + 2 \times 4$. (1 mark)

Calculate: $P = 18 + 8 = 26$ cm. Perimeter is a length. (1 mark)

Add the four sides: $9 + 4 + 9 + 4 = 26$ cm, matching the formula. (1 mark)

Answer: $P = 26$ cm; $9 + 4 + 9 + 4 = 26$ cm confirms it.

8. A bike hire business uses $C = 7h + 4$, where C is the total cost in dollars and h is the number of hours. Find the cost for [4 marks]

(a) 2 hours

(b) 4 hours. Mia says doubling 2 hours to 4 hours doubles the total cost. Use your results and the formula to explain whether she is correct.

For $h = 2$, $C = 7 \times 2 + 4 = 14 + 4 = 18$ dollars. (1 mark)

For $h = 4$, $C = 7 \times 4 + 4 = 28 + 4 = 32$ dollars. (1 mark)

Twice the 2-hour cost is $2 \times 18 = 36$ dollars, which is not 32 dollars. (1 mark)

The hourly part doubles, but the constant 4-dollar charge is added only once for each hire. Doubling the whole original cost would count that fixed charge twice. (1 mark)

Answer:

(a) 18 dollars

(b) 32 dollars. Mia is incorrect: twice 18 dollars is 36 dollars, while the 4-dollar fixed charge is paid only once.

Curriculum alignment

Australian Curriculum (ACARA), verified through QCAA | 9.0 | AC9M7A01

Use letters to express everyday formulas and replace known variables with numbers to calculate the remaining quantity. Notation and order-of-operations practice support this work; formal equation solving is taught separately.

Official curriculum source | Checked 2026-11-02