

Year 8 Algebra Starters

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Questions and short answers

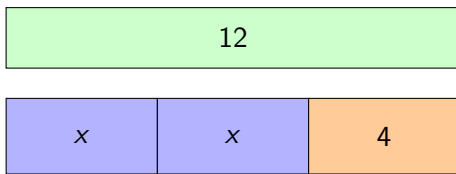
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Worked solutions

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Starter 1

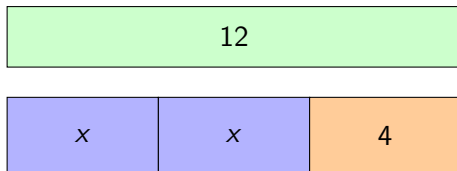
- ▶ Calculate: $-5 + 12 = \underline{\quad}$
- ▶ Collect like terms: $3x + 4x = \underline{\quad}$
- ▶ Expand: $3(x + 4) = \underline{\quad}$
- ▶ Solve: $x + 6 = 14 \Rightarrow \underline{\quad}$



- ▶ Write an equation represented by the bar model and solve it.
- ▶ If the total was 18 instead of 12, what would x be?
- ▶ Is $3(x + 4) = 3x + 4$ true or false? Explain.

Starter 1

- ▶ Calculate: $-5 + 12 = 7$
- ▶ Collect like terms: $3x + 4x = 7x$
- ▶ Expand: $3(x + 4) = 3x + 12$
- ▶ Solve: $x + 6 = 14 \Rightarrow x = 8$



- ▶ Write an equation represented by the bar model and solve it.
 $2x + 4 = 12$, so $x = 4$.
- ▶ If the total was 18 instead of 12, what would x be $x = 7$.
- ▶ Is $3(x + 4) = 3x + 4$ true or false? Explain. False, because $3(x + 4) = 3x + 12$.

Worked Solution: Starter 1, Question 1

Question: Calculate $-5 + 12 = _$.

Worked Solution:

Worked Solution: Starter 1, Question 1

Question: Calculate $-5 + 12 = 7$.

Worked Solution: Start at -5 and move 12 units to the right, landing on 7.

Worked Solution: Starter 1, Question 2

Question: Collect like terms: $3x + 4x = \underline{\hspace{1cm}}$.

Worked Solution:

Worked Solution: Starter 1, Question 2

Question: Collect like terms: $3x + 4x = 7x$.

Worked Solution: Add the coefficients: $3 + 4 = 7$, so $3x + 4x = 7x$.

Worked Solution: Starter 1, Question 3

Question: Expand: $3(x + 4) = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 1, Question 3

Question: Expand: $3(x + 4) = 3x + 12$.

Worked Solution: Multiply each term inside the bracket by 3:

$$3(x + 4) = 3x + 12.$$

Worked Solution: Starter 1, Question 4

Question: Solve: $x + 6 = 14 \Rightarrow$ _____.

Worked Solution:

Worked Solution: Starter 1, Question 4

Question: Solve: $x + 6 = 14 \Rightarrow x = 8$.

Worked Solution: Subtract 6 from both sides: $x = 14 - 6 = 8$.

Worked Solution: Starter 1, Question 5

Question: Write an equation represented by the bar model and solve it.

Worked Solution:

Worked Solution: Starter 1, Question 5

Question: Write an equation represented by the bar model and solve it.

Worked Solution: The two x -blocks and the 4-block make the total 12, so $2x + 4 = 12$. Subtract 4: $2x = 8$; divide by 2: $x = 4$.

Worked Solution: Starter 1, Question 6

Question: If the total was 18 instead of 12, what would x be?

Worked Solution:

Worked Solution: Starter 1, Question 6

Question: If the total was 18 instead of 12, what would x be $x = 7$.

Worked Solution: The model becomes $2x + 4 = 18$. Subtract 4:
 $2x = 14$, so $x = 7$.

Worked Solution: Starter 1, Question 7

Question: Is $3(x + 4) = 3x + 4$ true or false? Explain.

Worked Solution:

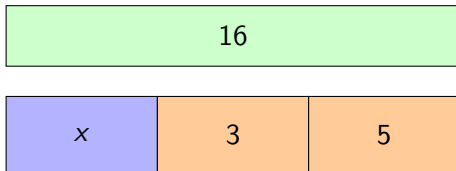
Worked Solution: Starter 1, Question 7

Question: Is $3(x + 4) = 3x + 4$ true or false? Explain.

Worked Solution: False. Expanding $3(x + 4)$ gives $3x + 12$, not $3x + 4$.

Starter 2

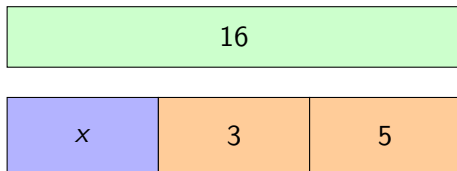
- ▶ Calculate: $6 - 11 = \underline{\hspace{2cm}}$
- ▶ Collect like terms: $5x + 2 + 3x = \underline{\hspace{2cm}}$
- ▶ Expand: $4(a + 2) = \underline{\hspace{2cm}}$
- ▶ Solve: $2x = 14 \Rightarrow \underline{\hspace{2cm}}$



- ▶ Write the equation represented by the bar model and solve it.
- ▶ Which part of the diagram represents the constant?
- ▶ Create a bar model for $8x + 2 = 26$.
- ▶ Simplify: $ax + bx = \underline{\hspace{2cm}}$

Starter 2

- ▶ Calculate: $6 - 11 = -5$
- ▶ Collect like terms: $5x + 2 + 3x = 8x + 2$
- ▶ Expand: $4(a + 2) = 4a + 8$
- ▶ Solve: $2x = 14 \Rightarrow x = 7$



- ▶ Write the equation represented by the bar model and solve it.
 $x + 3 + 5 = 16$, so $x = 8$.
- ▶ Which part of the diagram represents the constant? The 3 and 5 blocks (total 8).
- ▶ Create a bar model for $8x + 2 = 26$. Eight x -blocks and a 2-block, with total 26.
- ▶ Simplify: $ax + bx = (a + b)x$

Worked Solution: Starter 2, Question 1

Question: Calculate $6 - 11 = \underline{\hspace{1cm}}$.

Worked Solution:

Worked Solution: Starter 2, Question 1

Question: Calculate $6 - 11 = -5$.

Worked Solution: Start at 6 and move 11 units left: $6 - 11 = -5$.

Worked Solution: Starter 2, Question 2

Question: Collect like terms: $5x + 2 + 3x = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 2, Question 2

Question: Collect like terms: $5x + 2 + 3x = 8x + 2$.

Worked Solution: Collect the x -terms: $5x + 3x = 8x$; keep the constant $+2$: $8x + 2$.

Worked Solution: Starter 2, Question 3

Question: Expand: $4(a + 2) = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 2, Question 3

Question: Expand: $4(a + 2) = 4a + 8$.

Worked Solution: Multiply each term by 4: $4(a + 2) = 4a + 8$.

Worked Solution: Starter 2, Question 4

Question: Solve: $2x = 14 \Rightarrow$ _____.

Worked Solution:

Worked Solution: Starter 2, Question 4

Question: Solve: $2x = 14 \Rightarrow x = 7$.

Worked Solution: Divide both sides by 2: $x = \frac{14}{2} = 7$.

Worked Solution: Starter 2, Question 5

Question: Write the equation represented by the bar model and solve it.

Worked Solution:

Worked Solution: Starter 2, Question 5

Question: Write the equation represented by the bar model and solve it.

Worked Solution: The bar model has $x + 3 + 5 = 16$. Since $3 + 5 = 8$, we get $x + 8 = 16$, so $x = 8$.

Worked Solution: Starter 2, Question 6

Question: Which part of the diagram represents the constant?

Worked Solution:

Worked Solution: Starter 2, Question 6

Question: Which part of the diagram represents the constant?

Worked Solution: The 3 and 5 blocks have no x , so together they represent the constant 8.

Worked Solution: Starter 2, Question 7

Question: Create a bar model for $8x + 2 = 26$.

Worked Solution:

Worked Solution: Starter 2, Question 7

Question: Create a bar model for $8x + 2 = 26$.

Worked Solution: Draw eight equal x -blocks and one 2-block, with total 26.



Worked Solution: Starter 2, Question 8

Question: Simplify: $ax + bx =$ _____.

Worked Solution:

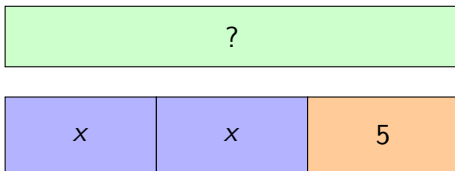
Worked Solution: Starter 2, Question 8

Question: Simplify: $ax + bx = (a + b)x$.

Worked Solution: Factor out the common x : $ax + bx = (a + b)x$.

Starter 3

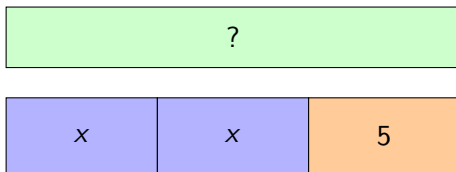
- ▶ Calculate: $-3 + 8 = \underline{\quad}$
- ▶ Collect like terms: $6a + 3 + 2a = \underline{\quad}$
- ▶ Expand: $2(x + 7) = \underline{\quad}$
- ▶ Solve: $x - 4 = 9 \Rightarrow \underline{\quad}$



- ▶ Suppose the total is 17. Write and solve the equation.
- ▶ Suppose the total is 25. What is x now?
- ▶ Expand: $3(x + 7) = \underline{\quad}$
- ▶ Expand: $3(x - 7) = \underline{\quad}$

Starter 3

- ▶ Calculate: $-3 + 8 = 5$
- ▶ Collect like terms: $6a + 3 + 2a = 8a + 3$
- ▶ Expand: $2(x + 7) = 2x + 14$
- ▶ Solve: $x - 4 = 9 \Rightarrow x = 13$



- ▶ Suppose the total is 17. Write and solve the equation.
 $2x + 5 = 17$, so $x = 6$.
- ▶ Suppose the total is 25. What is x now $x = 10$.
- ▶ Expand: $3(x + 7) = 3x + 21$
- ▶ Expand: $3(x - 7) = 3x - 21$

Worked Solution: Starter 3, Question 1

Question: Calculate $-3 + 8 = _$.

Worked Solution:

Worked Solution: Starter 3, Question 1

Question: Calculate $-3 + 8 = 5$.

Worked Solution: Start at -3 and move 8 units right: $-3 + 8 = 5$.

Worked Solution: Starter 3, Question 2

Question: Collect like terms: $6a + 3 + 2a = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 3, Question 2

Question: Collect like terms: $6a + 3 + 2a = 8a + 3$.

Worked Solution: Collect a -terms: $6a + 2a = 8a$; keep $+3$: $8a + 3$.

Worked Solution: Starter 3, Question 3

Question: Expand: $2(x + 7) = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 3, Question 3

Question: Expand: $2(x + 7) = 2x + 14$.

Worked Solution: Multiply each term by 2: $2(x + 7) = 2x + 14$.

Worked Solution: Starter 3, Question 4

Question: Solve: $x - 4 = 9 \Rightarrow$ _____.

Worked Solution:

Worked Solution: Starter 3, Question 4

Question: Solve: $x - 4 = 9 \Rightarrow x = 13$.

Worked Solution: Add 4 to both sides: $x = 9 + 4 = 13$.

Worked Solution: Starter 3, Question 5

Question: Suppose the total is 17. Write and solve the equation.

Worked Solution:

Worked Solution: Starter 3, Question 5

Question: Suppose the total is 17. Write and solve the equation.

Worked Solution: The model has two x -blocks and a 5-block, so
 $2x + 5 = 17$. Subtract 5: $2x = 12$, so $x = 6$.

Worked Solution: Starter 3, Question 6

Question: Suppose the total is 25. What is x now?

Worked Solution:

Worked Solution: Starter 3, Question 6

Question: Suppose the total is 25. What is x now $x = 10$.

Worked Solution: Now $2x + 5 = 25$. Subtract 5: $2x = 20$, so $x = 10$.

Worked Solution: Starter 3, Question 7

Question: Expand: $3(x + 7) = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 3, Question 7

Question: Expand: $3(x + 7) = 3x + 21$.

Worked Solution: $3(x + 7) = 3x + 21$.

Worked Solution: Starter 3, Question 8

Question: Expand: $3(x - 7) = \underline{\hspace{2cm}}$.

Worked Solution:

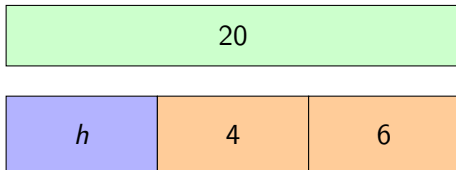
Worked Solution: Starter 3, Question 8

Question: Expand: $3(x - 7) = 3x - 21$.

Worked Solution: $3(x - 7) = 3x + 3(-7) = 3x - 21$.

Starter 4

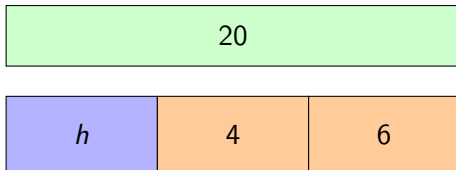
- ▶ Calculate: $-6 \div 3 = \underline{\hspace{2cm}}$
- ▶ Collect like terms: $9a - 4a + 2 + 3b = \underline{\hspace{2cm}}$
- ▶ Expand: $5(y + 3) = \underline{\hspace{2cm}}$
- ▶ Solve: $3d = 18 \Rightarrow \underline{\hspace{2cm}}$



- ▶ Write an equation represented by the diagram and solve for h .
- ▶ If the 4 block was instead h and the h block was 4, what equation would we have?
- ▶ Expand: $(x - 3)(x - 2) = \underline{\hspace{2cm}}$
- ▶ Simplify: $a^2 \times a \times b = \underline{\hspace{2cm}}$

Starter 4

- ▶ Calculate: $-6 \div 3 = -2$
- ▶ Collect like terms: $9a - 4a + 2 + 3b = 5a + 2 + 3b$
- ▶ Expand: $5(y + 3) = 5y + 15$
- ▶ Solve: $3d = 18 \Rightarrow d = 6$



- ▶ Write an equation represented by the diagram and solve for h .
 $h + 4 + 6 = 20$, so $h = 10$.
- ▶ If the 4 block was instead h and the h block was 4, what equation would we have $4 + h + 6 = 20$.
- ▶ Expand: $(x - 3)(x - 2) = x^2 - 5x + 6$
- ▶ Simplify: $a^2 \times a \times b = a^3b$

Worked Solution: Starter 4, Question 1

Question: Calculate $-6 \div 3 = \underline{\hspace{1cm}}$.

Worked Solution:

Worked Solution: Starter 4, Question 1

Question: Calculate $-6 \div 3 = -2$.

Worked Solution: Dividing -6 into three equal groups gives -2 ;
check: $3 \times (-2) = -6$.

Worked Solution: Starter 4, Question 2

Question: Collect like terms: $9a - 4a + 2 + 3b =$ _____.

Worked Solution:

Worked Solution: Starter 4, Question 2

Question: Collect like terms: $9a - 4a + 2 + 3b = 5a + 2 + 3b$.

Worked Solution: $9a - 4a = 5a$; the constant 2 and the b -term $3b$ stay separate, so $5a + 2 + 3b$.

Worked Solution: Starter 4, Question 3

Question: Expand: $5(y + 3) = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 4, Question 3

Question: Expand: $5(y + 3) = 5y + 15$.

Worked Solution: $5(y + 3) = 5y + 5 \cdot 3 = 5y + 15$.

Worked Solution: Starter 4, Question 4

Question: Solve: $3d = 18 \Rightarrow$ _____.

Worked Solution:

Worked Solution: Starter 4, Question 4

Question: Solve: $3d = 18 \Rightarrow d = 6$.

Worked Solution: Divide both sides by 3: $d = 18/3 = 6$.

Worked Solution: Starter 4, Question 5

Question: Write an equation represented by the diagram and solve for h .

Worked Solution:

Worked Solution: Starter 4, Question 5

Question: Write an equation represented by the diagram and solve for h .

Worked Solution: The diagram gives $h + 4 + 6 = 20$, so $h + 10 = 20$, hence $h = 10$.

Worked Solution: Starter 4, Question 6

Question: If the 4 block was instead h and the h block was 4, what equation would we have?

Worked Solution:

Worked Solution: Starter 4, Question 6

Question: If the 4 block was instead h and the h block was 4, what equation would we have $4 + h + 6 = 20$.

Worked Solution: After swapping the labels, the equation is $4 + h + 6 = 20$, which still gives $h = 10$.

Worked Solution: Starter 4, Question 7

Question: Expand: $(x - 3)(x - 2) =$ _____.

Worked Solution:

Worked Solution: Starter 4, Question 7

Question: Expand: $(x - 3)(x - 2) = x^2 - 5x + 6$.

Worked Solution: Use FOIL: $x^2 - 2x - 3x + 6 = x^2 - 5x + 6$.

Worked Solution: Starter 4, Question 8

Question: Simplify: $a^2 \times a \times b = \underline{\hspace{1cm}}$.

Worked Solution:

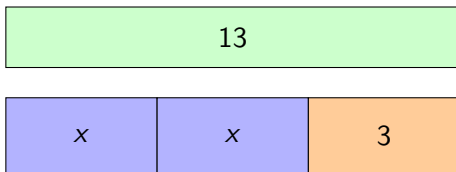
Worked Solution: Starter 4, Question 8

Question: Simplify: $a^2 \times a \times b = a^3b$.

Worked Solution: Combine the powers of a : $a^2 \times a = a^3$, then multiply by b : a^3b .

Starter 5

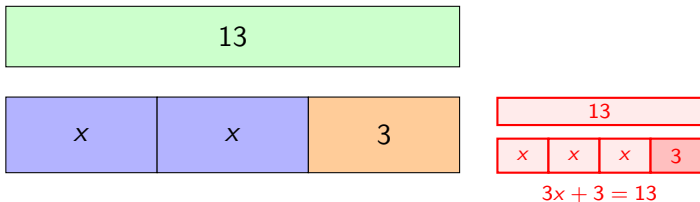
- ▶ Calculate: $7 - 12 = \underline{\quad}$
- ▶ Collect like terms: $2x + 7 + 3x = \underline{\quad}$
- ▶ Expand: $3(a + 5) = \underline{\quad}$
- ▶ Solve: $2x + 3 = 11 \Rightarrow \underline{\quad}$



- ▶ Write and solve the equation represented by the model.
- ▶ Explain how each part of the diagram matches the equation.
- ▶ Draw a bar model to represent $3x + 3 = 13$.
- ▶ Write an equation with solution $x = 5$.

Starter 5

- ▶ Calculate: $7 - 12 = -5$
- ▶ Collect like terms: $2x + 7 + 3x = 5x + 7$
- ▶ Expand: $3(a + 5) = 3a + 15$
- ▶ Solve: $2x + 3 = 11 \Rightarrow x = 4$



- ▶ Write and solve the equation represented by the model.
 $2x + 3 = 13$, so $x = 5$.
- ▶ Explain how each part of the diagram matches the equation.
Two x -blocks and a 3-block make the total 13.
- ▶ Draw a bar model to represent $3x + 3 = 13$.
- ▶ Write an equation with solution $x = 5$. e.g. $x + 2 = 7$.

Worked Solution: Starter 5, Question 1

Question: Calculate $7 - 12 = \underline{\hspace{1cm}}$.

Worked Solution:

Worked Solution: Starter 5, Question 1

Question: Calculate $7 - 12 = -5$.

Worked Solution: $7 - 12 = -(12 - 7) = -5$.

Worked Solution: Starter 5, Question 2

Question: Collect like terms: $2x + 7 + 3x = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 5, Question 2

Question: Collect like terms: $2x + 7 + 3x = 5x + 7$.

Worked Solution: $2x + 3x = 5x$; keep $+7$: $5x + 7$.

Worked Solution: Starter 5, Question 3

Question: Expand: $3(a + 5) = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 5, Question 3

Question: Expand: $3(a + 5) = 3a + 15$.

Worked Solution: $3(a + 5) = 3a + 15$.

Worked Solution: Starter 5, Question 4

Question: Solve: $2x + 3 = 11 \Rightarrow$ _____.

Worked Solution:

Worked Solution: Starter 5, Question 4

Question: Solve: $2x + 3 = 11 \Rightarrow x = 4$.

Worked Solution: Subtract 3: $2x = 8$; divide by 2: $x = 4$.

Worked Solution: Starter 5, Question 5

Question: Write and solve the equation represented by the model.

Worked Solution:

Worked Solution: Starter 5, Question 5

Question: Write and solve the equation represented by the model.

Worked Solution: The model shows $2x + 3 = 13$. Subtract 3:

$2x = 10$, so $x = 5$.

Worked Solution: Starter 5, Question 6

Question: Explain how each part of the diagram matches the equation.

Worked Solution:

Worked Solution: Starter 5, Question 6

Question: Explain how each part of the diagram matches the equation.

Worked Solution: Two x -blocks give $2x$, the 3-block is the constant 3, and the total 13 is written above them.

Worked Solution: Starter 5, Question 7

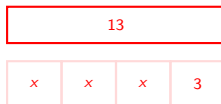
Question: Draw a bar model to represent $3x + 3 = 13$.

Worked Solution:

Worked Solution: Starter 5, Question 7

Question: Draw a bar model to represent $3x + 3 = 13$.

Worked Solution: Use three equal x -blocks, a 3-block, and total 13.



Worked Solution: Starter 5, Question 8

Question: Write an equation with solution $x = 5$.

Worked Solution:

Worked Solution: Starter 5, Question 8

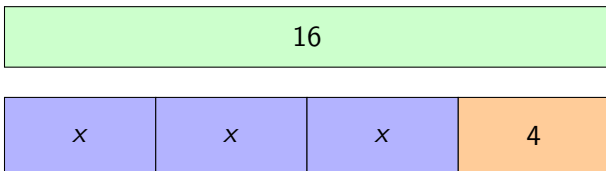
Question: Write an equation with solution $x = 5$.

Worked Solution: One example is $x + 2 = 7$, because $5 + 2 = 7$.

Many equations work.

Starter 6

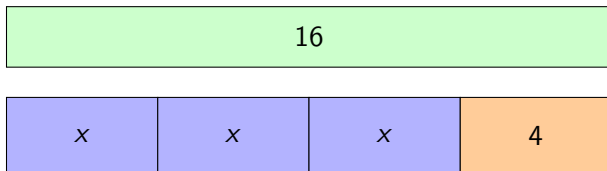
- ▶ Calculate: $-4 \times 6 =$ _____
- ▶ Collect like terms: $7x + 3x - 5 =$ _____
- ▶ Expand: $2(3x + 4) =$ _____
- ▶ Solve: $3x + 5 = 17 \Rightarrow$ _____
- ▶ Solve: $4x + 3 = 2x + 15 \Rightarrow$ _____
- ▶ Solve: $\frac{x}{3} + 4 = 9 \Rightarrow$ _____



- ▶ Write one equation that could be represented by this bar model.
- ▶ Write a different equation with the same solution.
- ▶ Create an equation with solution $x = 4$ that includes a

Starter 6

- ▶ Calculate: $-4 \times 6 = -24$
- ▶ Collect like terms: $7x + 3x - 5 = 10x - 5$
- ▶ Expand: $2(3x + 4) = 6x + 8$
- ▶ Solve: $3x + 5 = 17 \Rightarrow x = 4$
- ▶ Solve: $4x + 3 = 2x + 15 \Rightarrow x = 6$
- ▶ Solve: $\frac{x}{3} + 4 = 9 \Rightarrow x = 15$



- ▶ Write one equation that could be represented by this bar model. $3x + 4 = 16$.
- ▶ Write a different equation with the same solution. e.g. $2x + 3 = 11$.
- ▶ Create an equation with solution $x = 4$ that includes a

Worked Solution: Starter 6, Question 1

Question: Calculate $-4 \times 6 = \underline{\hspace{1cm}}$.

Worked Solution:

Worked Solution: Starter 6, Question 1

Question: Calculate $-4 \times 6 = -24$.

Worked Solution: $4 \times 6 = 24$, and one negative factor makes the product negative: -24 .

Worked Solution: Starter 6, Question 2

Question: Collect like terms: $7x + 3x - 5 =$ _____.

Worked Solution:

Worked Solution: Starter 6, Question 2

Question: Collect like terms: $7x + 3x - 5 = 10x - 5$.

Worked Solution: $7x + 3x = 10x$, so $10x - 5$.

Worked Solution: Starter 6, Question 3

Question: Expand: $2(3x + 4) = \underline{\hspace{2cm}}$.

Worked Solution:

Worked Solution: Starter 6, Question 3

Question: Expand: $2(3x + 4) = 6x + 8$.

Worked Solution: $2(3x + 4) = 6x + 8$.

Worked Solution: Starter 6, Question 4

Question: Solve: $3x + 5 = 17 \Rightarrow$ _____.

Worked Solution:

Worked Solution: Starter 6, Question 4

Question: Solve: $3x + 5 = 17 \Rightarrow x = 4$.

Worked Solution: Subtract 5: $3x = 12$; divide by 3: $x = 4$.

Worked Solution: Starter 6, Question 5

Question: Solve: $4x + 3 = 2x + 15 \Rightarrow$ _____.

Worked Solution:

Worked Solution: Starter 6, Question 5

Question: Solve: $4x + 3 = 2x + 15 \Rightarrow x = 6$.

Worked Solution: Subtract $2x$ from both sides: $2x + 3 = 15$.

Subtract 3: $2x = 12$; divide by 2: $x = 6$.

Worked Solution: Starter 6, Question 6

Question: Solve: $\frac{x}{3} + 4 = 9 \Rightarrow$ _____.

Worked Solution:

Worked Solution: Starter 6, Question 6

Question: Solve: $\frac{x}{3} + 4 = 9 \Rightarrow x = 15$.

Worked Solution: Subtract 4: $\frac{x}{3} = 5$; multiply by 3: $x = 15$.

Worked Solution: Starter 6, Question 7

Question: Write one equation that could be represented by this bar model.

Worked Solution:

Worked Solution: Starter 6, Question 7

Question: Write one equation that could be represented by this bar model.

Worked Solution: The model has three x-blocks and a 4-block with total 16, so $3x + 4 = 16$.

Worked Solution: Starter 6, Question 8

Question: Write a different equation with the same solution.

Worked Solution:

Worked Solution: Starter 6, Question 8

Question: Write a different equation with the same solution.

Worked Solution: Since $3x + 4 = 16$ gives $x = 4$, a different equation is $2x + 3 = 11$, which also gives $x = 4$.

Worked Solution: Starter 6, Question 9

Question: Create an equation with solution $x = 4$ that includes a negative term.

Worked Solution:

Worked Solution: Starter 6, Question 9

Question: Create an equation with solution $x = 4$ that includes a negative term.

Worked Solution: For example, $2x - 3 = 5$: adding 3 gives $2x = 8$, so $x = 4$.