Year 9 substitution worksheet

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Name: _____ Date: _____

Question 1

The formula v = u + at gives the speed of an object. Find v when u = 4, a = 2.5 and t = 6.

Answer: _____

Question 2

The area of a trapezium is A = ½(a + b)h. Find A when a = 7, b = 11 and h = 6.

Answer: _____

Question 3

(a) Rearrange v = u + at to make t the subject.

(b) Use your formula to find t when v = 30, u = 6 and a = 4.

Answer: _____

Question 4

The formula C = 5/9(F - 32) converts a temperature in degrees Fahrenheit (F) to degrees Celsius (C).

(a) Find C when F = 77.

(b) Find F when C = 40.

Answer: _____

Question 5

The kinetic energy E joules of an object of mass m kg moving at v m/s is E = ½mv².

(a) Find E when m = 8 and v = 5.

(b) Rearrange the formula to make v the subject, given v > 0.

(c) Find v when E = 196 and m = 8.

Answer: _____

Question 6

The perimeter of a rectangle is P = 2(l + w).

(a) Find P when l = 8.5 and w = 4.25.

(b) Find w when P = 46 and l = 15.

Answer: _____

Question 7

The area of a trapezium is A = ½(a + b)h. A trapezium has area 48 cm², height 6 cm and one parallel side of 7 cm. Find the length of the other parallel side.

Answer: _____

Year 9 substitution: answers and worked solutions

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Question 1

Key idea: Substitute each value into the formula, then evaluate (multiplication before addition).

1. $v = 4 + 2.5 \times 6$ 2. $v = 4 + 15 = 19$

Answer: $v = 19$

Question 2

Key idea: Substitute the values. Work out the bracket first.

1. $A = \frac{1}{2}(7 + 11) \times 6$ 2. $A = \frac{1}{2} \times 18 \times 6 = 9 \times 6 = 54$

Answer: $A = 54$

Question 3

Key idea: To change the subject, undo the operations on t in reverse order, doing the same to both sides.

1. (a) Subtract u: $v - u = at$ 2. (a) Divide by a: $t = (v - u)/(a)$ 3. (b) $t = (30 - 6)/(4) = 24/4 = 6$

Answer: (a) $t = (v - u)/(a)$ (b) $t = 6$

Question 4

Key idea: Substitute the known value, then solve for the unknown.

1. (a) $C = 5/9(77 - 32) = 5/9 \times 45 = 25$ 2. (b) $40 = 5/9(F - 32)$; multiply by 9/5: $72 = F - 32$ 3. (b) $F = 72 + 32 = 104$

Answer: (a) $C = 25$ (b) $F = 104$

Question 5

Key idea: Substitute into the formula to evaluate it. To change the subject, undo each operation on v in reverse order: the last step undoes the square with a square root.

1. (a) $E = \frac{1}{2} \times 8 \times 5^2 = 4 \times 25 = 100$ 2. (b) Multiply by 2: $2E = mv^2$; divide by m: $v^2 = 2E/m$ 3. (b) Take the positive square root: $v = \sqrt{(2E/m)}$ 4. (c) $v = \sqrt{((2 \times 196)/(8))} = \sqrt{(49)} = 7$

Answer: (a) $E = 100$ (b) $v = \sqrt{(2E/m)}$ (c) $v = 7$

Question 6

Key idea: Substitute the known values, then solve for the unknown.

1. P = 2(8.5 + 4.25) = 2 × 12.75 = 25.5 2. 46 = 2(15 + w), so 23 = 15 + w and w = 8

Answer: (a) 25.5 (b) 8

Question 7

Key idea: Substitute the known values, then solve the equation.

1. 48 = ½(a + 7) × 6 2. 48 = 3(a + 7), so 16 = a + 7 3. a = 9

Answer: 9 cm