

Substitution

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (3 marks)

Work out the value of

(a) $3x$ when $x = 7$

$3x$ means $3 \times x$.

$$3 \times 7 = 21$$

Answer: 21

Tip: $3x$ means $3 \times x$. Replacing x with 7 gives 3×7 , not 37.

(b) $y + 8$ when $y = -3$

Replace y with -3 :

$$-3 + 8 = 5$$

Answer: 5

(c) $4p - 1$ when $p = 5$

Multiply first: $4 \times 5 = 20$

Then subtract 1: $20 - 1 = 19$

Answer: 19

2 (2 marks)

Work out the value of $10 - 3x + y$ when $x = 4$ and $y = -6$

$$3x = 3 \times 4 = 12$$

$$10 - 3x + y = 10 - 12 + (-6)$$

$$10 - 12 = -2$$

$$-2 + (-6) = -2 - 6 = -8$$

Answer: -8

Tip: Adding a negative number is the same as subtracting: $+(-6)$ means -6 .

Marks: 1 mark for $10 - 12 + (-6)$ or $10 - 12 - 6$. 1 mark for -8 .

3 (4 marks)

$$W = 8a - 3b$$

(a) Work out the value of W when $a = 2$ and $b = -4$

$$8a = 8 \times 2 = 16$$

$$3b = 3 \times (-4) = -12$$

$$W = 16 - (-12)$$

Subtracting a negative is the same as adding: $W = 16 + 12 = 28$

Answer: $W = 28$

Tip: $-3b$ with $b = -4$ is $-3 \times (-4) = +12$. A negative times a negative is positive.

Marks: 1 mark for $8 \times 2 - 3 \times (-4)$ or $16 + 12$. 1 mark for 28.

(b) When $a = 5$, $W = 25$

Work out the value of b .

Put the values you know into the formula:

$$25 = 8 \times 5 - 3b$$

$$25 = 40 - 3b$$

Add $3b$ to both sides: $3b + 25 = 40$

Subtract 25 from both sides: $3b = 15$

Divide both sides by 3: $b = 5$

Answer: $b = 5$

Tip: Substitute first, then solve. Check your answer: $8 \times 5 - 3 \times 5 = 40 - 15 = 25$.

Marks: 1 mark for $25 = 40 - 3b$ or $3b = 15$. 1 mark for 5.

4 (2 marks)

$$K = \frac{a + b}{c}$$

Work out the value of K when $a = -7$, $b = 19$ and $c = -4$

Work out the top first: $a + b = -7 + 19 = 12$

Then divide by c : $12 \div (-4) = -3$

Answer: $K = -3$

Tip: A positive number divided by a negative number gives a negative answer.

Marks: 1 mark for $\frac{-7+19}{-4}$ or $\frac{12}{-4}$. 1 mark for -3 .

5 (2 marks)

$$G = 30 - 2t^2$$

Work out the value of G when $t = -3$

Square first: $(-3)^2 = (-3) \times (-3) = 9$

Then multiply by 2: $2 \times 9 = 18$

Then subtract from 30: $G = 30 - 18 = 12$

Answer: $G = 12$

Tip: $(-3)^2$ is +9, not -9. Only t is squared: $2t^2$ is 2×9 , not $(2 \times 3)^2$.

Marks: 1 mark for 2×9 or 18. 1 mark for 12.

6 (2 marks)

$$y = x^2 - 5x + 6$$

Work out the value of y when $x = 4$

$$x^2 = 4^2 = 16$$

$$5x = 5 \times 4 = 20$$

$$y = 16 - 20 + 6 = 2$$

Answer: $y = 2$

Marks: 1 mark for $16 - 20 + 6$. 1 mark for 2.

7 (4 marks)

Hannah uses this formula to work out the cost, C pounds, of hiring a car for d days.

$$C = 20 + 15d$$

(a) Work out the cost of hiring a car for 4 days.

Replace d with 4:

$$C = 20 + 15 \times 4$$

$$\text{Multiply first: } 15 \times 4 = 60$$

$$\text{Then add: } C = 20 + 60 = 80$$

Answer: £80

Tip: Multiply before you add. $20 + 15 \times 4$ is not 35×4 .

Marks: 1 mark for $20 + 15 \times 4$. 1 mark for 80.

- (b) Hannah pays £125 to hire a car.
For how many days does she hire the car?

Now $C = 125$:

$$125 = 20 + 15d$$

Subtract 20 from both sides: $15d = 105$

Divide both sides by 15: $d = 7$

Answer: 7 days

Marks: 1 mark for $125 - 20$ or $15d = 105$. 1 mark for 7.

8 (3 marks)

Here is a rule to work out the time, in minutes, needed to cook a turkey.

Time = 40 minutes for each kg of weight, plus 20 minutes

- (a) Work out the time needed to cook a turkey of weight 5 kg.

40 minutes for each kg: $40 \times 5 = 200$

Plus 20 minutes: $200 + 20 = 220$

Answer: 220 minutes

Marks: 1 mark for $40 \times 5 + 20$. 1 mark for 220.

- (b) Write a formula for T , the time in minutes, in terms of w , the weight in kg.

40 minutes for each kg is $40 \times w = 40w$.

Then add 20.

A formula starts with ' $T =$ '.

Answer: $T = 40w + 20$

9 (2 marks)

$$x = 3 \text{ and } y = -4$$

Work out the value of $2x^2 - y$

$$2x^2 = 2 \times 3^2 = 2 \times 9 = 18$$

$$2x^2 - y = 18 - (-4)$$

Subtracting a negative is the same as adding: $18 + 4 = 22$

Answer: 22

Tip: $2x^2$ means $2 \times x^2$, so square 3 first: $2 \times 9 = 18$. It is not $(2 \times 3)^2 = 36$.

Marks: 1 mark for 18 and $-(-4)$. 1 mark for 22.

10 (2 marks)

Ellie works out the value of $x^2 + 2x$ when $x = -5$

She writes $-25 - 10 = -35$

(a) Explain the mistake Ellie has made.

Ellie worked out $(-5)^2$ as -25 .

But $(-5)^2 = (-5) \times (-5) = +25$

A negative times a negative is positive.

Answer: She should have $(-5)^2 = +25$, not -25 .

(b) Work out the correct value of $x^2 + 2x$ when $x = -5$

$$x^2 = (-5)^2 = 25$$

$$2x = 2 \times (-5) = -10$$

$$25 + (-10) = 25 - 10 = 15$$

Answer: 15

11 (3 marks)

$$v^2 = u^2 + 2as$$

v is positive.

Work out the value of v when $u = 3$, $a = 4$ and $s = 2$

Substitute into the formula:

$$v^2 = 3^2 + 2 \times 4 \times 2$$

$$v^2 = 9 + 16 = 25$$

This gives v^2 , so square root to find v :

$$v = \sqrt{25} = 5$$

Answer: $v = 5$

Tip: The formula gives v^2 , not v . Remember the last step: take the square root.

Marks: 1 mark for $3^2 + 2 \times 4 \times 2$. 1 mark for 25. 1 mark for 5.

12 (2 marks)

The area, A , of a trapezium is given by the formula $A = \frac{1}{2}(a + b)h$
where a and b are the lengths of the parallel sides and h is the height.

A trapezium has area 45 cm^2 .

Its parallel sides are 4 cm and 11 cm long.

Work out the height of the trapezium.

Substitute into the formula: $45 = \frac{1}{2}(4 + 11) \times h$

$$4 + 11 = 15, \text{ and } \frac{1}{2} \times 15 = 7.5$$

$$\text{So } 45 = 7.5h$$

Divide both sides by 7.5: $h = 45 \div 7.5 = 6$

Answer: $h = 6 \text{ cm}$

Tip: Add the parallel sides before you halve. $45 \div 7.5$ is the same as $90 \div 15 = 6$.

Marks: 1 mark for $45 = \frac{1}{2}(4 + 11)h$ or $45 = 7.5h$. 1 mark for 6.

13 (2 marks)

$$F = 1.8C + 32$$

Work out the value of C when $F = 50$

Put $F = 50$ into the formula:

$$50 = 1.8C + 32$$

Subtract 32 from both sides: $1.8C = 18$

Divide both sides by 1.8: $C = 18 \div 1.8 = 10$

Answer: $C = 10$

Tip: Here you know F , not C . Put $F = 50$ in and solve the equation. Do not put 50 in place of C .

Marks: 1 mark for $50 - 32$ or $1.8C = 18$. 1 mark for 10.
