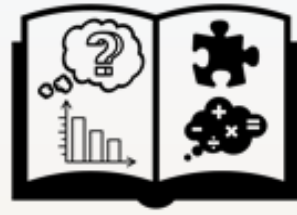


Foundation



Maths GCSE Problem Solving Questions Workbook

Substitution

GRADES 1 – 4



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Substituting into formula

EXAMPLE

This formula is used to work out the cost (£) of tiling a path

Cost = number of tiles \times 5 + 25

46 tiles are needed to tile a path, work out the cost.

$$\text{Cost} = 46 \times 5 + 25$$

$$\text{Cost} = 230 + 25 = \text{£}255$$

1

Corey wants to carpet his room.

The room is a rectangle, length 6 m and width 4.2 m.

He uses the formula below to work out the cost of the carpet.

$$C = \frac{8}{3}A + 50$$

C is the cost in pounds and A is the area of the room in m^2 .

How much should the carpet cost?



2

a) Work out the cost of a bike repair when

- Hours worked = 3
- Cost of parts = £ 110



Ben's Bike Repairs

Price of repairs are as follows:

Hours worked \times £16

+

Cost of parts



b) The cost of repairs for one bike was £200 and the parts cost £104.

How many hours did the repairer work on it?



3

a) Work out the cost of a car repair when

- Hours worked = 5 hours
- Number of parts replaced = 3



Colin's Car Repairs

Price of repairs are as follows:

Hours worked \times £15

+

No. of parts replaced \times £80



b) The cost of repairs for one car was £220 and the mechanic worked on the car for 4 hours.

How many parts were replaced?



Substituting into expressions

EXAMPLE

Here are three expressions.

$$x^3 - 20$$

$$x^2 - 2$$

$$x + 4$$

For one value of x , all three expressions have the same value.

Use trial & improvement or any other method to work out this value of x .

Try 1 = -19 , 1 , 5 **No**
Try 2 = -12 , 2 , 6 **No**
Try 3 = 7 , 7 , 7 **Yes**
 $x = 3$

Alternate:

$$x^2 - 2 = x + 4$$

$$x^2 - x - 6 = 0$$

$$(x - 3)(x + 2) = 0$$

$$x = 3 \text{ or } -2 \text{ ---- test by substitution}$$

1 Here are three expressions.

$$x^2 - 20$$

$$10 - x$$

$$2x - 5$$

For one value of x , all three expressions have the same value.

Use trial and improvement or any other method to work out this value of x .



2 Here are three expressions.

$$x^2 + 12$$

$$2x^2 - x$$

$$6x + 4$$

For one value of x , all three expressions have the same value.

Use trial and improvement or any other method to work out this value of x .



3 Here are three expressions.

$$x^3 + 10$$

$$x^2 - 2$$

$$4x + 10$$

For one value of x , all three expressions have the same value.

Use trial and improvement or any other method to work out this value of x .



Substituting into expressions

EXAMPLE

Which of the following expressions will give the median value when

$n = 4$? $\frac{1}{n}$ $n - 1$ $n + 1$ n^2 \sqrt{n}

You must show your working.

$\frac{1}{4}$	3	5	16	2
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Median – middle value when in order

$\frac{1}{4}$	2	3	5	16
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Median = $n - 1$

- 1 Which of the following expressions will give the median value when $n = 9$?

$\frac{1}{n}$ $2n$ $n + 5$ n^2 \sqrt{n}



- 2 Calculate the median of these expressions when $n = 5$?

$\frac{1}{n}$ $2n$ $n + 5$ n^2 $4n - 2$ $2n + 6$



- 3 Calculate the mean of these expressions when $n = 8$?

$\frac{n}{2}$ $2n$ $n + 6$ n^2 $2n + 6$ $4n - 2$



- 4 Calculate the mode of these expressions when $n = -2$?

$\frac{n}{2}$ $2n$ $n + 3$ n^2 $3n + 2$ $4 + n$



Solutions

Page 1 – Substitution into formula

1. £117.20 =: Area = $6 \times 4.2 = 25.2 \text{ m}^2$

Cost = $\frac{8}{3} \times A + 50 = 117.20$

2. a) £158 : Cost = $3 \times 16 + 110 = 48 + 110$

b) 6 hours : Cost = $16x + 104 = £200$

$16x = 200 - 104 \rightarrow 16x = 96 \rightarrow x = 96 \div 16$

3. a) £315 : Cost = $5 \times 15 + 3 \times 80 = 75 + 240$

b) 2 parts : Cost = $15x + 80y = £220$

$\rightarrow 60 + 80x = 220 \rightarrow 80x = 160 \rightarrow x = 2$

Page 2 – Substitution into expressions

1. $x = 5$: Try 3 = -11, 7, 1 No

Try 4 = -4, 6, 3 No

Try 5 = 5, 5, 5 Yes

Alternate: $2x - 5 = 10 - x$

$3x = 15 \rightarrow x = 5$ - test by substitution

2. $x = 4$: Try 2 = 16, 6, 16 No

Try 3 = 21, 15, 22 No

Try 4 = 28, 28, 28 Yes

Alternate: $x^2 + 12 = 6x + 4$

$x^2 - 6x + 8 = 0 \rightarrow (x - 4)(x - 2) = 0$

$x = 4$ or $2 \rightarrow$ test by substitution

3. $x = -2$: Try 2 = 18, 2, 18 No

Try 3 = 37, 7, 22 No

Try 4 = 74, 14, 26 No

Not working so need to use equation

$x^2 - 2 = 4x + 10 \rightarrow x^2 - 4x - 12 = 0$

$(x - 6)(x + 2) = 0$

$x = 6$ or $-2 \rightarrow$ test by substitution

Try $-2 = 2, 2, 2$ Yes

Page 3 – Substitution into expressions

1. Median = $n + 5 : \frac{1}{9}, 18, 14, 81, 3$

2. Median = $13 : \frac{1}{5}, 10, 10, 25, 18, 16$

Median = $(10 + 16) \div 2 = 13$

3. Mean = $25 : 4, 16, 14, 64, 30, 22$

Total = $4 + 16 + 14 + 64 + 30 + 22 = 150$

Mean = $150 \div 6 = 25$

4. Mode = $-4 : -1, -4, 1, 4, -4, 2$