

Name _____

Date _____

2.2 Using expressions and formulae — worked answers

Substitute numbers into expressions, and write and use formulae. · 56 questions

A · Fluency — Substitute values into expressions and formulae.

- 1 Work out the value of $3x + 2$ when $x = 4$.
Answer: 14
Substitute the value: $3x + 2$ with $x = 4$ gives 14.
- 2 Work out the value of $5n - 7$ when $n = 3$.
Answer: 8
Substitute the value: $5n - 7$ with $n = 3$ gives 8.
- 3 Work out the value of $2a + 3b$ when $a = 5$, $b = 2$.
Answer: 16
Substitute the values: $2a + 3b$ with $a = 5$, $b = 2$ gives 16.
- 4 Work out the value of $4(y + 1)$ when $y = 6$.
Answer: 28
Substitute the value: $4(y + 1)$ with $y = 6$ gives 28.
- 5 Work out the value of $x^2 + 1$ when $x = 5$.
Answer: 26
Substitute the value: $x^2 + 1$ with $x = 5$ gives 26.
- 6 Work out the value of $10 - 2k$ when $k = 7$.
Answer: -4
Substitute the value: $10 - 2k$ with $k = 7$ gives -4.
- 7 Work out the value of $p/2 + 4$ when $p = 10$.
Answer: 9
Substitute the value: $p/2 + 4$ with $p = 10$ gives 9.
- 8 Work out the value of $6m - m$ when $m = 9$.
Answer: 45
Substitute the value: $6m - m$ with $m = 9$ gives 45.
- 9 Work out the value of $3(c - 2)$ when $c = 8$.
Answer: 18
Substitute the value: $3(c - 2)$ with $c = 8$ gives 18.
- 10 Work out the value of $ab + 5$ when $a = 3$, $b = 4$.
Answer: 17
Substitute the values: $ab + 5$ with $a = 3$, $b = 4$ gives 17.

- 11** Work out the value of $2x + 3y - z$ when $x = 4$, $y = 2$, $z = 5$.

Answer: 9

Substitute the values: $2x + 3y - z$ with $x = 4$, $y = 2$, $z = 5$ gives 9.

- 12** Work out the value of $t^2 - 3t$ when $t = 6$.

Answer: 18

Substitute the value: $t^2 - 3t$ with $t = 6$ gives 18.

- 13** Work out the value of $50 \div w$ when $w = 5$.

Answer: 10

Substitute the value: $50 \div w$ with $w = 5$ gives 10.

- 14** Work out the value of $2(a + b)$ when $a = 7$, $b = 3$.

Answer: 20

Substitute the values: $2(a + b)$ with $a = 7$, $b = 3$ gives 20.

- 15** Work out the value of $9 - 4h$ when $h = 2$.

Answer: 1

Substitute the value: $9 - 4h$ with $h = 2$ gives 1.

- 16** Work out the value of $5x - 2$ when $x = -3$.

Answer: -17

Substitute the value: $5x - 2$ with $x = -3$ gives -17.

- 17** Work out the value of n^2 when $n = -4$.

Answer: 16

Substitute the value: n^2 with $n = -4$ gives 16.

- 18** Work out the value of $3d + 8$ when $d = -5$.

Answer: -7

Substitute the value: $3d + 8$ with $d = -5$ gives -7.

- 19** $A = l \times w$ — The area A of a rectangle of length l and width w . Work out A when $l = 5$, $w = 4$. Give your answer in cm^2 .

Answer: 20

Substitute $l = 5$, $w = 4$ into $A = l \times w$: the answer is 20 cm^2 .

- 20** $P = 2(l + w)$ — The perimeter P of a rectangle of length l and width w . Work out P when $l = 9$, $w = 4$. Give your answer in cm .

Answer: 26

Substitute $l = 9$, $w = 4$ into $P = 2(l + w)$: the answer is 26 cm .

- 21** $C = 5n$ — The cost C of n tickets at \$5 each. Work out C when $n = 7$. Give your answer in dollars.

Answer: 35

Substitute $n = 7$ into $C = 5n$: the answer is 35 dollars.

- 22** $D = st$ — The distance D travelled at speed s for time t . Work out D when $s = 60$, $t = 3$. Give your answer in km .

Answer: 180

Substitute $s = 60$, $t = 3$ into $D = st$: the answer is 180 km .

- 23** $V = lwh$ — The volume V of a cuboid. Work out V when $l = 4$, $w = 3$, $h = 5$. Give your answer in cm^3 .

Answer: 60

Substitute $l = 4$, $w = 3$, $h = 5$ into $V = lwh$: the answer is 60 cm^3 .

- 24** $C = x + y$ — The total cost C of one adult ticket $\$x$ and one child ticket $\$y$. Work out C when $x = 12$, $y = 7$. Give your answer in dollars.

Answer: 19

Substitute $x = 12$, $y = 7$ into $C = x + y$: the answer is 19 dollars.

B · Reasoning — Write formulae and judge whether they are clear.

- 25** Write a formula for the perimeter P of a square with side length s .

Answer: $4s$

All four sides are equal, so $P = 4s$.

- 26** Write a formula for the total cost C , in dollars, of n books at $\$8$ each.

Answer: $8n$

Each book costs $\$8$, so $C = 8n$.

- 27** Write a formula for the number of minutes M in h hours.

Answer: $60h$

There are 60 minutes in an hour, so $M = 60h$.

- 28** Write a formula for the change C , in dollars, from $\$50$ after spending $\$x$.

Answer: $-x + 50$

$C = 50 - x$.

- 29** A plumber charges a $\$40$ call-out fee plus $\$25$ per hour. Write a formula for the total charge T for h hours.

Answer: $25h + 40$

The hourly charge is $25h$ and the call-out is a one-off $\$40$, so $T = 25h + 40$.

- 30** Using $T = 25h + 40$, what is the charge for 3 hours, in dollars?

Answer: 115

$25 \times 3 + 40 = 75 + 40 = 115$.

- 31** Yola uses $C = x + y$ for the total cost of an adult and a child swim. Why is this formula hard to use?

- ☐ It has too many letters
- ☐ The letters x and y do not suggest what they stand for
- ☐ It should use multiplication
- ☐ It is wrong

Answer: The letters x and y do not suggest what they stand for

A better formula would be $C = a + c$, with a for adult and c for child — or you must state clearly what each letter means.

- 32** Mateo uses $W = p - q$ for the wire left after cutting a small piece from a large piece. What must p stand for?

- ☐ The small piece
- ☐ The large piece
- ☐ The wire left over
- ☐ Either piece

Answer: The large piece

You subtract the small piece from the large one, so p is the large piece and q the small piece.

- 33** What value of k makes $k + 10$ and $3k$ give the same answer?

Answer: 5

$k + 10 = 3k$ gives $10 = 2k$, so $k = 5$. Check: $5 + 10 = 15$ and $3 \times 5 = 15$ ✓

- 34** What value of k makes $3k$ and $20 - k$ give the same answer?

Answer: 5

$3k = 20 - k$ gives $4k = 20$, so $k = 5$. Check: 15 and 15 ✓

- 35** The formula for converting degrees Celsius to Fahrenheit is $F = 1.8C + 32$. Work out F when $C = 20$.

Answer: 56

$1.8 \times 20 + 32 = 36 + 32 = 56$.

- 36** Using $F = 1.8C + 32$, work out F when $C = 0$.

Answer: 32

$1.8 \times 0 + 32 = 32$, so 0°C is 32°F .

C · Challenge — Work backwards and handle negatives.

- 37** The formula for the perimeter of a rectangle is $P = 2(l + w)$. A rectangle has $P = 30$ cm and $l = 9$ cm. Work out w , in cm.

Answer: 6

$2(9 + w) = 30$ so $9 + w = 15$ and $w = 6$ cm.

- 38** Using $A = lw$, a rectangle has area 48 cm^2 and length 8 cm. Work out its width, in cm.

Answer: 6

$48 \div 8 = 6$ cm.

- 39** The formula $T = 25h + 40$ gives a plumber's charge. A job cost \$190. How many hours did it take?

Answer: 6

$25h + 40 = 190$ so $25h = 150$ and $h = 6$ hours.

- 40** Work out the value of $3x^2$ when $x = -4$.

Answer: 48

$(-4)^2 = 16$ first, then $3 \times 16 = 48$. The index applies to x only, but x is negative so squaring makes it positive.

- 41** Work out the value of $2a - 3b$ when $a = -5$ and $b = 2$.

Answer: -16

$2 \times (-5) = -10$ and $3 \times 2 = 6$, so $-10 - 6 = -16$.

- 42** $V = lwh$ gives the volume of a cuboid. A cuboid has volume 60 cm^3 , length 5 cm and width 4 cm . Work out its height, in cm .

Answer: 3

$5 \times 4 = 20$, and $60 \div 20 = 3 \text{ cm}$.

- 43** A taxi fare is $F = 2k + 3$ dollars for k kilometres. A fare was $\$19$. How many kilometres was the journey?

Answer: 8

$2k + 3 = 19$ so $2k = 16$ and $k = 8 \text{ km}$.

- 44** Two formulae give the same answer: $A = 4n$ and $B = 2n + 18$. For what value of n ?

Answer: 9

$4n = 2n + 18$ gives $2n = 18$, so $n = 9$.

D · Word problems — Formulae from real contexts.

- 45** A phone plan costs $C = 15 + 0.2m$ dollars, where m is the number of extra minutes. Work out the cost, in dollars, for 40 extra minutes.

Answer: 23

$0.2 \times 40 = 8$, and $15 + 8 = 23$ dollars.

- 46** A rectangle is 12 cm long and 7 cm wide. Use $A = lw$ to find its area, in cm^2 .

Answer: 84

$12 \times 7 = 84 \text{ cm}^2$.

- 47** The same rectangle: use $P = 2(l + w)$ to find its perimeter, in cm .

Answer: 38

$2(12 + 7) = 2 \times 19 = 38 \text{ cm}$.

- 48** A car travels at 80 km/h for 2 hours. Use $D = st$ to find the distance, in km .

Answer: 160

$80 \times 2 = 160 \text{ km}$.

- 49** A cuboid box is 6 cm by 5 cm by 4 cm . Use $V = lwh$ to find its volume, in cm^3 .

Answer: 120

$6 \times 5 \times 4 = 120 \text{ cm}^3$.

- 50** A shop sells notebooks for $\$3$ each with a $\$2$ postage charge. The total cost is $C = 3n + 2$. Find the cost, in dollars, of 7 notebooks.

Answer: 23

$3 \times 7 + 2 = 21 + 2 = 23$ dollars.

- 51** Using $C = 3n + 2$, how many notebooks can be bought for exactly $\$32$?

Answer: 10

$3n + 2 = 32$ so $3n = 30$ and $n = 10$ notebooks.

- 52** A gym charges a $\$50$ joining fee plus $\$30$ a month. Write the total for 8 months, in dollars.

Answer: 290

$30 \times 8 + 50 = 240 + 50 = 290$ dollars.

- 53** The number of legs L on a farm with c cows and h hens is $L = 4c + 2h$. Work out L when $c = 12$ and $h = 30$.

Answer: 108

$$4 \times 12 + 2 \times 30 = 48 + 60 = 108 \text{ legs.}$$

- 54** A tank holds $W = 25t$ litres after t minutes. How many litres after 7 minutes?

Answer: 175

$$25 \times 7 = 175 \text{ litres.}$$

- 55** Using $W = 25t$, how many minutes to reach 500 litres?

Answer: 20

$$500 \div 25 = 20 \text{ minutes.}$$

- 56** A printer costs \$80 plus \$12 for each ink cartridge. Find the total cost, in dollars, of the printer and 5 cartridges.

Answer: 140

$$12 \times 5 + 80 = 60 + 80 = 140 \text{ dollars.}$$