

**ALGEBRA - SUBSTITUTION - PRACTICE QUESTIONS**  
**CALCULATOR ALLOWED**



1.  
 $a = 2b + 3c$

Find the value of  $a$  when  $b = 5$  and  $c = 2$ .

$$a = 2 \times 5 + 3 \times 2 = 16$$

2.  
 $d = 5e - 2f$

Find the value of  $d$  when  $e = 4$  and  $f = 6$ .

$$5 \times 4 - 2 \times 6 = 8$$

3.  
 $g = 4h - i$

Find the value of  $g$  when  $h = 2$  and  $i = -5$ .

$$4 \times 2 - -5 = 13$$

4.  
 $z = x^2 - 3y$

Find the value of  $z$  when  $x = 3$  and  $y = -2$ .

$$3^2 - 3 \times -2 = 15$$

5.  
 $t = 3s^2 - 4u$

Find the value of  $t$  when  $s = -3$  and  $u = 4$ .

$$3 \times (-3)^2 - 4 \times 4 = 11$$

6.

Below are four algebraic expressions.

$3x + y$

$2x^2$

$5y - x$

$y + 12$

Which expression gives the largest value when  $x = 3$  and  $y = 4$ ?

$3 \times 3 + 4 = 13$

$2 \times 3^2 = 18$

$5 \times 4 - 3 = 17$

$4 + 12 = 16$

$2x^2$

7.

Below are four algebraic expressions.

$5p + 2q$

$p^2 - 5$

$3(p - q)$

$q^2 + 9$

Which expression gives the largest value when  $p = 4$  and  $q = -2$ ?

$5 \times 4 + 2 \times -2 = 16$

$4^2 - 5 = 11$

$3(4 - (-2)) = 18$

$(-2)^2 + 9 = 13$

$3(p - q)$

8.

Below are four algebraic expressions.

$a^3 + 5$

$3a - 4b$

$a(5a + b)$

$b^a$

Which expression gives the smallest value when  $a = 2$  and  $b = -3$ ?

$2^3 + 5 = 13$

$3 \times 2 - 4 \times -3 = 18$

$2(2 \times 5 - 3) = 14$

$(-3)^2 = 9$

$3a - 4b$

9.

$$p = r + at$$

Find the value of  $p$  when  $r = 5$ ,  $a = 2$  and  $t = 6$ .

$$5 + 2 \times 6 = \underline{17}$$

10.

$$A = 5c - de$$

Find the value of  $A$  when  $c = 4$ ,  $d = 0.5$  and  $e = 12$ .

$$5 \times 4 - 0.5 \times 12 = \underline{14}$$

11.

$$w^2 = u^2 - 2vz$$

Find the value of  $w$  when  $u = -6$ ,  $v = 1$  and  $z = 10$ .

$$\begin{aligned} w^2 &= (-6)^2 - 2 \times 1 \times 10 \\ &= 16 \end{aligned}$$

$$\underline{w = 4}$$

12.

$$x^2 = y^2 + 4wz$$

Find the value of  $x$  when  $y = 3$ ,  $w = 5$  and  $z = 2$ .

$$\begin{aligned} x^2 &= 3^2 + 4 \times 5 \times 2 \\ &= 49 \end{aligned}$$

$$\underline{x = 7}$$

13.

$$L = 3m + n$$

Find the value of  $n$  when  $L = 20$  and  $m = 4$ .

$$20 = 3 \times 4 + n$$

$$20 = 12 + n$$

$$\underline{n = 8}$$

14.

$$A = 4b - 3d$$

Find the value of  $b$  when  $A = 9$  and  $d = 3$ .

$$9 = 4b - 3 \times 3$$

$$9 = 4b - 9$$

$$18 = 4b$$

$$\underline{b = 4.5}$$

15.

$$w = 10z + 3t$$

Find the value of  $z$  when  $w = 21$  and  $t = -3$ .

$$21 = 10z + 3 \times -3$$

$$21 = 10z - 9$$

$$30 = 10z$$

$$\underline{z = 3}$$

16.

$$r = 3p^2 + 2q$$

Find the value of  $q$  when  $r = 10$  and  $p = 2$ .

$$10 = 3 \times 2^2 + 2q$$

$$10 = 12 + 2q$$

$$-2 = 2q$$

$$\underline{q = -1}$$

17.

The formula below can be used to work out the cost in pounds (C) of hiring a bike for h hours.

$$C = 9h + 5$$

- (a) Carla wants to hire a bike for 4 hours.  
Work out how much Carla will pay.

$$9 \times 4 + 5 = \underline{\underline{\pounds 41}}$$

- (b) Darren also hired a bike.  
He paid £50.

Work out how many hours Darren hired the bike for.

$$50 = 9h + 5$$

$$45 = 9h$$

$$h = 5$$

5 hours

18.

The formula below can be used to convert temperatures between ° Celsius (C) and ° Fahrenheit (F).

$$F = 2C + 30$$

- (a) The temperature in Athens is 28°C.  
Work out the temperature in Athens in ° Fahrenheit.

$$2 \times 28 + 30 = \underline{\underline{86^\circ \text{F}}}$$

- (b) The temperature in Helsinki is 20°F.  
Work out the temperature in Helsinki in ° Celsius.

$$20 = 2C + 30$$

$$-10 = 2C$$

$$C = -5$$

-5°C

19.

A taxi company uses this formula to calculate the cost (C) of a journey.

$$C = 5 + 1.5m + B$$

where m is the number of miles travelled and B is a booking fee.

(a) Mae booked a taxi with the company.

She travelled 6 miles and paid £15.50.

Work out the booking fee.

$$15.5 = 5 + 1.5 \times 6 + B$$

$$1.5 = B$$

£1.50

(b) Noreen also booked a taxi with the company.

She travelled 10 miles.

Work out how much Noreen paid.

$$5 + 1.5 \times 10 + 1.5 = \underline{\underline{£21.50}}$$

20.

The formula below can be used to calculate the temperature in Celsius (T) at different heights on Mount Everest.

$$T = \frac{48}{h} - 36$$

where h is the height in kilometres.

(a) A hiker has set up a base at a height of 1,500 metres.

Work out the temperature at the base.

$$\frac{48}{1.5} - 36 = \underline{\underline{-4^\circ\text{C}}}$$

(b) The temperature at another base on the mountain is  $-20^\circ\text{C}$ .

How high up the mountain is the base, in kilometres?

$$-20 = \frac{48}{h} - 36$$

$$16 = \frac{48}{h}$$

$$h = 3$$

3 kilometres

21.

The formula below is used to calculate the number of points (P) a football team has.

$$P = 3W + D$$

where W is the number of games won and D is the number of games drawn.

(a) Liverpool have won 24 games and drawn 8 games.

Everton have won 16 games and drawn 6 games.

How many more points do Liverpool have than Everton?

$$\text{Liverpool} = 3 \times 24 + 8 = 80$$

$$\text{Everton} = 3 \times 16 + 6 = 54$$

$$80 - 54 = \underline{26 \text{ points}}$$

(b) Manchester United have played 38 games.

They have drawn 13 games and have 79 points.

How many games have Manchester United lost?

$$79 = 3W + 13$$

$$66 = 3W$$

$$W = 22$$

$$D = 13$$

$$22 + 13 = 35$$

$$38 - 35 = 3$$

3 games

22.

Aaron works for a company selling car and home insurances.

His monthly pay in pounds (P) can be calculated using the formula below.

$$P = 1250 + \frac{C}{40} + \frac{3H}{100}$$

where C is the total value of the car insurances he sells and H is the total value of the home insurances he sells.

In June, Aaron sold 6 car insurances worth £260 each and 2 home insurances worth £350 each.

Work out Aaron's pay in June.

$$C = 6 \times 260 = 1560$$

$$H = 2 \times 350 = 700$$

$$P = 1250 + \frac{1560}{40} + \frac{700 \times 3}{100}$$

$$= \underline{\underline{£1,310}}$$

23.

Below are 5 numbers.

$$a + b \\ 8$$

$$b^2 \\ 9$$

$$2a - b \\ 7$$

$$a^2 - 1 \\ 24$$

$$5b + 9 \\ 24$$

(a) Find the mode of the numbers when  $a = 5$  and  $b = 3$ .

$$5 + 3 = 8$$

$$3^2 = 9$$

$$2 \times 5 - 3 = 7$$

$$5^2 - 1 = 24$$

$$5 \times 3 + 9 = 24$$

(24)

(b) Find the median of the numbers when  $a = 3$  and  $b = 4$ .

$$3 + 4 = 7$$

$$4^2 = 16$$

$$2 \times 3 - 4 = 2$$

$$3^2 - 1 = 8$$

$$5 \times 4 + 9 = 29$$

2, 7, 8, 16, 29

(8)

24.

The formula below can be used to calculate the final velocity in metres per second ( $v$ ) of a journey.

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

where  $u$  is the initial velocity in metres per second,  $a$  is the acceleration in metres per second per second

(a) A car travelled from point A to point B.

The distance between point A and point B is 88 metres.

The car's initial velocity was 2 metres per second.

The car's acceleration was 0.75 metres per second per second.

Work out the car's final velocity, to 1 decimal place.

$$v^2 = 2^2 + 2 \times 0.75 \times 88 \\ = 136$$

$$v = \sqrt{136} = 11.7 \text{ metres per second}$$

(b) Another car travelled from point C to point D.

The car's initial velocity was 3 metres per second.

The car's final velocity was 15 metres per second.

The car's acceleration was 1.02 metres per second.

Work out the distance travelled, to the nearest metre.

$$15^2 = 3^2 + 2 \times 1.02 \times s \\ 225 = 9 + 2.04s$$

$$216 = 2.04s$$

$$s = 105.882 \dots$$

106 metres