

## 2.4 Substitution into Formulae

1. The speed of a bike,  $v$  metres per second, is given by the formula

$$v = u + ft$$

when  $u$  is its initial speed (in m/s),  $f$  its acceleration (in m/s<sup>2</sup>) and  $t$ , the time in seconds.

Determine  $v$  when

- (a)  $u = 0$ ,  $f = 5$  and  $t = 10$                       (b)  $u = 20$ ,  $f = 2$  and  $t = 5$   
(c)  $u = 20$ ,  $f = 0$  and  $t = 5$                       (d)  $u = 40$ ,  $f = -5$  and  $t = 5$   
(e)  $u = 40$ ,  $f = -5$  and  $t = 8$

In each case, briefly describe the motion of the bike.

2. The Fahrenheit scale, (F) and the Celsius scale (C) are related by the formula

$$F = \frac{9}{5}C + 32$$

- (a) Give the following temperatures in Fahrenheit.  
(i) Normal body temperature: 37 °C  
(ii) Boiling point of water: 100 °C  
(b) Give the following temperatures in degrees Celsius.  
(i) Freezing point of water: 32 °F  
(ii) Singapore's average daily temperature: 86 °F  
3. If  $x = 3$ ,  $y = 4$  and  $z = 7$ , find the values of the following expressions:

- (a)  $5yz$                       (b)  $xyz$                       (c)  $\frac{12}{xy}$   
(d)  $\frac{xy}{18}$                       (e)  $2x + 3y$                       (f)  $x - 5y + 2z$   
(g)  $xy + yz$                       (h)  $x^2 + y^2$                       (i)  $2z^2 + y$   
(j)  $y^2 + x^3$                       (k)  $xy^2$                       (l)  $4x^2y^2$

4. If  $a = 3$ ,  $b = 2$  and  $c = -1$ , find the value of each of the following.

- (a)  $a^3 + b^3 + c^3 - 2abc$                       (b)  $(2a + b - c)(4b - 3c)$   
(c)  $(a - b)^2 - (b - c)^2$                       (d)  $\frac{a}{b} + \frac{b}{c} - \frac{c}{a}$   
(e)  $\frac{a+1}{2} - \frac{b+c}{4} + \frac{c-a}{3}$                       (f)  $a^b - c^a + b^a$   
(g)  $2a - 3b^2 + 3abc^2$                       (h)  $a^2 + 3b^3 - 4c^5$   
(i)  $\frac{a+b}{c} - \frac{ab-c}{b}$                       (j)  $\frac{3a-b}{b-c} + \frac{a+c}{b-a}$   
(k)  $\frac{2c^2-3a}{bc-a} - \frac{4b}{3a}$                       (l)  $\frac{a^2-b^2}{c^2} - \frac{a^3-c}{(c-3b)}$

5. Find the value of  $x^3 + 2xy^2 + y^3$  when  $x = 2$  and  $y = -1$ .

6. Find the value of  $\frac{x+1}{x-1} + \frac{2x-1}{2x+1}$  when  $x = -2$ .

7. Find the value of  $2ab + 3bc^2$  when  $a = 0$ ,  $b = 5$  and  $c = -2$ .

8. The distance travelled,  $s$  metres, by a car is given by

$$s = ut + \frac{1}{2}ft^2$$

Here  $u$  is the car's initial speed (in m/s),  $t$  the time (in seconds) and  $f$  the acceleration (in  $\text{m/s}^2$ ).

(a) Find  $s$  when

(i)  $u = 0$ ,  $t = 10$ ,  $f = 5$

(ii)  $u = 20$ ,  $t = 5$ ,  $f = 6$

(iii)  $u = 50$ ,  $t = 4$ ,  $f = -5$

(iv)  $u = 60$ ,  $t = 10$ ,  $f = -2$

(b) If the car travels 400 metres in 5 seconds with initial speed of 40 m/s, what is its acceleration?

9. (a) Work out the value of  $3a + ac$  when  $a = 4$  and  $c = -5$ .

(b) Work out the value of  $3p^2 - 5$  when  $p = 2$ .

*(Edexcel)*

10. Use the formula

$$v = u + at$$

to find the value of  $v$  when  $u = -10$ ,  $a = 1.8$  and  $t = 3.7$ .

*(AQA)*

11. A table has four columns: A, B, C and D. Part of the table is shown.

A	B	C	D
1	6	94	36
2		93	49
4	9		
7			144

- (a) This is the 2nd row of the table.

A	B	C	D
2		93	49

$$\text{The number in column B} = \text{the number in column A} + 5$$

Work out the number in column B in this row.

- (b) This is the the 3rd row of the table.

A	B	C	D
4	9		

- (i)  $\text{The number in column C} = 100 - \text{the number in column B}$

Work out the number in column C in this row.

- (ii)  $\text{The number in column D} = \text{the number in column B squared}$

Work out the number in column D in this row.

- (c) This is the 4th row of the table.

A	B	C	D
7			144

Work out the number in column C in this row.

(AQA)

12. To cook roast lamb in a moderate oven, my recipe book gives these times.

*78 minutes per kilogram, plus 35 minutes*

- (a) How long should I cook a 1.6 kg joint of lamb?  
Give your answer in minutes to the nearest minute.
- (b) Write your answer to part (a) in hours and minutes.
- (c) I cooked one joint of lamb for 230 minutes. What was the weight of this joint?

(OCR)