

# Substitution

## EXERCISE 20(A)

### Question 1.

Fill in the following blanks, when :

$x = 3, y = 6, z = 18, a = 2, b = 8, c = 32$  and  $d = 0$ .

(i)  $x + y =$  .....

(ii)  $y - x =$  .....

(iii)  $\frac{y}{x} =$  .....

(iv)  $c \div b =$  .....

(v)  $z \div x =$  .....

(vi)  $y \times d =$  .....

(vii)  $d \div x =$  .....

(viii)  $ab + y =$  .....

(ix)  $a + b + x =$  .....

(x)  $b + z - d =$  .....

(xi)  $a - b + y =$  .....

(xii)  $z - a - b =$  .....

(xiii)  $d - a + x =$  .....

(xiv)  $xy - bd =$  .....

(xv)  $xz + cd =$  .....

**Solution:**

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- (i)  $x + y = 3 + 6 = 9$
- (ii)  $y - x = 6 - 3 = 3$
- (iii)  $\frac{y}{x} = \frac{6}{3} = 2$
- (iv)  $c + b = \frac{c}{b} = \frac{32}{8} = 4$
- (v)  $z + x = \frac{z}{x} = \frac{18}{3} = 6$
- (vi)  $y \times d = 6 \times 0 = 0$
- (vii)  $d + x = \frac{d}{x} = \frac{0}{3} = 0$
- (viii)  $ab + y = 2 \times 8 + 6 = 16 + 6 = 22$
- (ix)  $a + b + x = 2 + 8 + 3 = 13$
- (x)  $b + z - d = 8 + 18 - 0 = 26$
- (xi)  $a - b + y = 2 - 8 + 6 = 8 - 8 = 0$
- (xii)  $z - a - b = 18 - 2 - 8 = 18 - 10 = 8$
- (xiii)  $d - a + x = 0 - 2 + 3 = 1$
- (xiv)  $xy - bd = 3 \times 6 - 8 \times 0 = 18 - 0 = 18$
- (xv)  $xz + cd = 3 \times 18 + 32 \times 0 = 54 + 0 = 54$

### Question 2.

Find the value of :

- (i)  $p + 2q + 3r$ , when  $p = 1$ ,  $q = 5$  and  $r = 2$
- (ii)  $2a + 4b + 5c$ , when  $a = 5$ ,  $b = 10$   
and  $c = 20$
- (iii)  $3a - 2b$ , when  $a = 8$  and  $b = 10$
- (iv)  $5x + 3y - 6z$ , when  $x = 3$ ,  
 $y = 5$  and  $z = 4$
- (v)  $2p - 3q + 4r - 8s$ , when  $p = 10$ ,  
 $q = 8$ ,  $r = 6$ ,  
and  $s = 2$
- (vi)  $6m - 2n - 5p - 3q$ , when  $m = 20$ ,  
 $n = 10$ ,  $p = 2$  and  $q = 9$

**Solution:**

$$\begin{aligned} \text{(i) } p + 2q + 3r &= 1 + 2 \times 5 + 3 \times 2 \\ &= 1 + 10 + 6 = 17 \end{aligned}$$

$$\begin{aligned} \text{(ii) } 2a + 4b + 5c &= 2 \times 5 + 4 \times 10 + 5 \times 20 \\ &= 10 + 40 + 100 = 150 \end{aligned}$$

$$\begin{aligned} \text{(iii) } 3a - 2b &= 3 \times 8 - 2 \times 10 \\ &= 24 - 20 = 4 \end{aligned}$$

$$\begin{aligned} \text{(iv) } 5x + 3y - 6z &= 5 \times 3 + 3 \times 5 - 6 \times 4 \\ &= 15 + 15 - 24 = 30 - 24 = 6 \end{aligned}$$

$$\begin{aligned} \text{(v) } 2p - 3q + 4r - 8s &= 2 \times 10 - 3 \times 8 + 4 \times 6 - 8 \times 2 \\ &= 20 - 24 + 24 - 16 \\ &= 20 - 16 = 4 \end{aligned}$$

$$\begin{aligned} \text{(vi) } 6m - 2n - 5p - 3q &= 6 \times 20 - 2 \times 10 - 5 \times 2 - 3 \times 9 \\ &= 120 - 20 - 10 - 27 \\ &= 120 - 57 = 63 \end{aligned}$$

### Question 3.

Find the value of :

$$\text{(i) } 4pq \times 2r, \text{ when } p = 5, q = 3 \text{ and } r = 1/2$$

$$\text{(ii) } \frac{yx}{z}, \text{ when } x = 8, y = 4 \text{ and } z = 16$$

$$\text{(iii) } \frac{a+b-c}{2a}, \text{ when } a = 5, b = 7 \text{ and } c = 2$$

**Solution:**

$$\text{(i) } 4pq \times 2r = 4 \times 5 \times 3 \times 2 \times \frac{1}{2} = 60$$

$$\text{(ii) } \frac{yx}{z} = \frac{4 \times 8}{16} = \frac{32}{16} = 2$$

$$\text{(iii) } \frac{a+b-c}{2a} = \frac{5+7-2}{2 \times 5} = \frac{12-2}{10} = \frac{10}{10} = 1$$

### Question 4.

If  $a = 3$ ,  $b = 0$ ,  $c = 2$  and  $d = 1$ , find the value of :

- (i)  $3a + 2b - 6c + 4d$
- (ii)  $6a - 3b - 4c - 2d$
- (iii)  $ab - bc + cd - da$
- (iv)  $abc - bcd + cda$
- (v)  $a^2 + 2b^2 - 3c^2$
- (vi)  $a^2 + b^2 - c^2 + d^2$
- (vii)  $2a^2 - 3b^2 + 4c^2 - 5d^2$

**Solution:**

$$\begin{aligned} \text{(i) } 3a + 2b - 6c + 4d \\ &= 3 \times 3 + 2 \times 0 - 6 \times 2 + 4 \times 1 \\ &= 9 + 0 - 12 + 4 = 13 - 12 = 1 \end{aligned}$$

$$\begin{aligned} \text{(ii) } 6a - 3b - 4c - 2d \\ &= 6 \times 3 - 3 \times 0 - 4 \times 2 - 2 \times 1 \\ &= 18 - 0 - 8 - 2 = 18 - 10 = 8 \end{aligned}$$

$$\begin{aligned} \text{(iii) } ab - bc + cd - da \\ &= 3 \times 0 - 0 \times 2 + 2 \times 1 - 1 \times 3 \\ &= 0 + 0 + 2 - 3 = -1 \end{aligned}$$

$$\begin{aligned} \text{(iv) } abc - bcd + cda \\ &= 3 \times 0 \times 2 - 0 \times 2 \times 1 + 2 \times 1 \times 3 \\ &= 0 - 0 + 6 = 6 \end{aligned}$$

$$\begin{aligned} \text{(v) } a^2 + 2b^2 - 3c^2 \\ &= 3^2 + 2 \times 0^2 - 3 \times 2^2 \\ &= 9 + 0 - 3 \times 4 \\ &= 9 - 12 = -3 \end{aligned}$$

$$\begin{aligned} \text{(vi) } a^2 + b^2 - c^2 + d^2 \\ &= (3)^2 + (0)^2 - (2)^2 + (1)^2 \\ &= 9 + 0 - 4 + 1 = 6 \end{aligned}$$

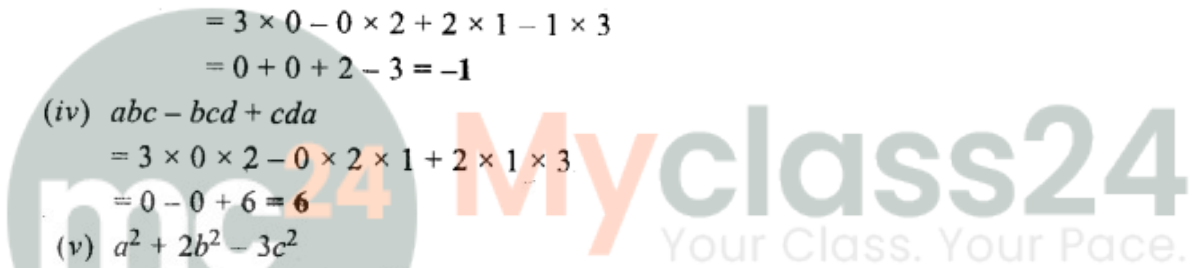
$$\begin{aligned} \text{(vii) } 2a^2 - 3b^2 + 4c^2 - 5d^2 \\ &= 2(3)^2 - 3(0)^2 + 4(2)^2 - 5(1)^2 \\ &= 2 \times 9 - 0 + 4 \times 4 - 5 \times 1 \\ &= 18 - 0 + 16 - 5 = 34 - 5 = 29 \end{aligned}$$

**Question 5.**

Find the value of  $5x^2 - 3x + 2$ , when  $x = 2$ .

**Solution:**

$$\begin{aligned} 5x^2 - 3x + 2 &= 5(2)^2 - 3(2) + 2 \\ &= 5(4) - 6 + 2 \\ &= 20 + 2 - 6 = 16 \end{aligned}$$



**Question 6.**

Find the value of  $3x^3 - 4x^2 + 5x - 6$ , when  $x = -1$ .

**Solution:**

$$\begin{aligned} & 3x^3 - 4x^2 + 5x - 6 \\ &= 3(-1)^3 - 4(-1)^2 + 5(-1) - 6 \\ &= 3 \times -1 - 4 \times 1 - 5 - 6 \\ &= -3 - 4 - 5 - 6 = -18 \end{aligned}$$

**Question 7.**

Show that the value of  $x^3 - 8x^2 + 12x - 5$  is zero, when  $x = 1$ .

**Solution:**

$$\begin{aligned} & x^3 - 8x^2 + 12x - 5 \\ &= (1)^3 - 8(1)^2 + 12(1) - 5 \\ &= 1 - 8 + 12 - 5 \\ &= 13 - 13 = 0 \text{ Hence proved.} \end{aligned}$$

**Question 8.**

State true and false :

- (i) The value of  $x + 5 = 6$ , when  $x = 1$
- (ii) The value of  $2x - 3 = 1$ , when  $x = 0$
- (iii)  $\frac{2x-4}{x+1} = -1$ , when  $x = 1$

**Solution:**

(i) True, verification  $x + 5 = 6$ ,  
When  $x = 1$ ,  $1 + 5 = 6$

**$6 = 6$  Hence proved.**

(ii)  $2x - 3 = 1$ , when  $x = 0$

$$2 \times 0 - 3 = 1, 0 - 3 = 1,$$

**$-3 = 1$  False.**

(iii)  $\frac{2x-4}{x+1} = -1$ , when  $x = 1 = \frac{2 \times 1 - 4}{1 + 1} = -1$

$$= \frac{2-4}{2} = -1 = \frac{-2}{2} = -1$$

**$= -1 = -1$  True.**

**Question 9.**

If  $x = 2$ ,  $y = 5$  and  $z = 4$ , find the value of each of the following :

$$(i) \frac{x}{2x^2}$$

$$(ii) \frac{xz}{yz}$$

$$(iii) z^x$$

$$(iv) y^x$$

$$(v) \frac{x^2 y^2 z^2}{xz}$$

$$(vi) \frac{5x^4 y^2 z^2}{2x^2}$$

$$(vii) xy + y^2 z$$

$$(viii) \frac{x^2 y^x}{x}$$

**Solution:**

$$(i) \frac{x}{2x^2} = \frac{2}{2(2)^2} = \frac{2}{2 \times 4} = \frac{1}{4}$$

$$(ii) \frac{xz}{yz} = \frac{2 \times 4}{5 \times 4} = \frac{2}{5}$$

$$(iii) z^x = 4^2 = 4 \times 4 = 16$$

$$(iv) y^x = 5^2 = 5 \times 5 = 25$$

$$(v) \frac{x^2 y^2 z^2}{xz} = \frac{(2)^2 \times (5)^2 \times (4)^2}{2 \times 4}$$
$$= (2)^{2-1} \times (5)^2 \times (4)^{2-1}$$
$$= 2 \times 5 \times 5 \times 4 = 200$$

$$(vi) \frac{5x^4 y^2 z^2}{2x^2} = \frac{5x^{4-2} y^2 z^2}{2} = \frac{5x^2 y^2 z^2}{2}$$
$$= \frac{5(2)^2 (5)^2 (4)^2}{2} = \frac{5 \times 4 \times 25 \times 16}{2}$$
$$= 5 \times 2 \times 25 \times 16 = 4,000$$

$$(vii) \frac{xy}{y^2 z} = \frac{x}{y^{2-1} z} = \frac{x}{yz} = \frac{2}{5 \times 4} = \frac{1}{10}$$

$$(viii) \frac{x^2 y^x}{x} = x^{2-1} y^x = xy^x = (2)(5)^2$$
$$= 2 \times 25 = 50$$

**Question 10.**

If  $a = 3$ , find the values of  $a^2$  and  $2^a$ .

**Solution:**

$$a^2 = (3)^2 = 3 \times 3 = 9$$

$$2^a = (2)^3 = 2 \times 2 \times 2 = 8$$

**Question 11.**

If  $m = 2$ , find the difference between the values of  $4m^3$  and  $3m^4$ .

**Solution:**

$$4m^3 = 4(2)^3 = 4 \times 2 \times 2 \times 2 = 32$$

$$3m^4 = 3(2)^4 = 3 \times 2 \times 2 \times 2 \times 2 = 48$$

$$\text{Now, a difference } 3m^4 - 4m^3 = 48 - 32 = 16$$

