

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$$

$$(a + b - c)^2 = a^2 + b^2 + c^2 + 2(ab - bc - ca)$$

$$(a - b + c)^2 = a^2 + b^2 + c^2 + 2(-ab - bc + ca)$$

$$(-a + b + c)^2 = a^2 + b^2 + c^2 + 2(-ab + \overline{bc} - ca)$$



24. The algebraic expression $25x^2 + 16y^2 + 9z^2 - 40xy + 24yz - 30zx$ is equal to:

बीजीय व्यंजक $25x^2 + 16y^2 + 9z^2 - 40xy + 24yz - 30zx$ निम्नलिखित में से किसके बराबर है:

[A] $(4y + 3z - 5x)^2$

[B] $(4y - 3z - 5x)(4x + 5y + 3z)$

[C] $(4y + 3z - 5x)(4x + 5y - 3z)$

[D] $(4y - 3z - 5x)^2$

$(-5x + 4y + 3z)^2$

25. If $2x^2 + y^2 + 8z^2 - 2\sqrt{2}xy + 4\sqrt{2}yz - 8zx = (Ax + y + Bz)^2$, then the value of $(A^2 + B^2 - AB)$ is:

यदि $2x^2 + y^2 + 8z^2 - 2\sqrt{2}xy + 4\sqrt{2}yz - 8zx = (Ax + y + Bz)^2$ है, तो $(A^2 + B^2 - AB)$ का मान है:

[A] 16

[B] 14

[C] 6

[D] 18

$$= 2 + 8 - (-4) \\ = 14$$

$$(-\sqrt{2}x + y + 2\sqrt{2}z)^2 = (Ax + y + Bz)^2$$

$$A = -\sqrt{2}$$

$$B = 2\sqrt{2}$$

$$8 = (2\sqrt{2})^2$$

26. If $\frac{a^2+b^2+c^2-1024}{ab-bc-ca} = -2$ & $a+b=5c$, where $c>0$, then the value of c is?

यदि $\frac{a^2+b^2+c^2-1024}{ab-bc-ca} = -2$ & $a+b=5c$ है, जहा पे $c>0$, तो c का मान है?

[A] 8

[B] 4

[C] 12

[D] 5

$$(a+b)-c=32$$

$$4c=32$$

$$c=8$$

~~$$a^2+b^2+c^2=1024=-2ab+2bc+2ca$$~~

$$a^2+b^2+c^2+2ab-2bc-2ca=1024$$

$$(a+b-c)^2=1024$$



$$(a + b - c)^2 = (a^2 + b^2 + c^2) + 2(ab + bc + ca)$$

$$a^2 + b^2 + c^2 = (a + b + c)^2 - 2(ab + bc + ca) \checkmark$$

$$(ab + bc + ca) = \frac{(a + b + c)^2 - (a^2 + b^2 + c^2)}{2}$$



27. If $\frac{a}{b} + \frac{b}{c} + \frac{c}{a} = 11$ and $\frac{b}{a} + \frac{c}{b} + \frac{a}{c} = 8$ then find the value of $\frac{a^2}{b^2} + \frac{b^2}{c^2} + \frac{c^2}{a^2}$?

यदि $\frac{a}{b} + \frac{b}{c} + \frac{c}{a} = 11$ और $\frac{b}{a} + \frac{c}{b} + \frac{a}{c} = 8$ है, तो $\frac{a^2}{b^2} + \frac{b^2}{c^2} + \frac{c^2}{a^2}$ का मान ज्ञात कीजिए।

RRB NTPC 2021

[A] 105

[B] 19

[C] 137

[D] 75

$$\left(\frac{a}{b}\right)^2 + \left(\frac{b}{c}\right)^2 + \left(\frac{c}{a}\right)^2 = \left(\frac{a}{b} + \frac{b}{c} + \frac{c}{a}\right)^2 - 2\left(\frac{a}{c} + \frac{b}{a} + \frac{c}{b}\right)$$

$$= 11^2 - 2 \times 8$$

$$= 105$$



$$4 \times 9 = 6^2$$

$$4^2 + 9^2 + 6^2 = 133$$



28. If $x + y + z = 19$, $x^2 + y^2 + z^2 = 133$, and $xz = y^2$, then the difference between z and x is:

यदि $x + y + z = 19$, $x^2 + y^2 + z^2 = 133$, और $xz = y^2$ तो z और x के बीच का अंतर है:

[A] 5

[B] 3

[C] 6

[D] 4

$$x + z = 13$$

$$xz = 36$$

$$xy + yz + zx = \frac{19^2 - 133}{2} = 114$$

$$xy + yz + y^2 = 114$$

$$y \cdot (x + z + y) = 114$$

$$y \times 19 = 114$$

$$y = 6$$



$$a^2 + b^2 + c^2 - ab - bc - ca = \frac{1}{2} [(a-b)^2 + (b-c)^2 + (c-a)^2]$$

Example:-

If,

$$a = 891$$

$$b = 894$$

$$c = 899$$

तो $a^2 + b^2 + c^2 - ab - bc - ca = ?$

$$= \frac{1}{2} [9 + 25 + 64]$$

$$= \frac{1}{2} \times 98$$

$$= 49$$



36. Find $6637^2 + 6640^2 + 6642^2 - 6637 \times 6640 - 6640 \times 6642 - 6642 \times 6637$?

$6637^2 + 6640^2 + 6642^2 - 6637 \times 6640 - 6640 \times 6642 - 6642 \times 6637$ का मान ज्ञात कीजिए।

[A] 13

[C] 21

[B] 17

[D] 19

$$= \frac{1}{2} \cdot [9 + 4 + 25]$$

$$= 19$$

a $\rightarrow$ 6637
b $\rightarrow$ 6640
c $\rightarrow$ 6642

37. If $a - b = 2$ & $b - c = 3$, then find the value of $a^2 + b^2 + c^2 - ab - bc - ca$?

यदि $a - b = 2$ & $b - c = 3$ है, तो $a^2 + b^2 + c^2 - ab - bc - ca$ का मान ज्ञात किजिए?

[A] 20

add

[B] 18

[C] 19

[D] 31

$$= \frac{1}{2} [(a-b)^2 + (b-c)^2 + (c-a)^2]$$

$$a - c = 5$$

$$= \frac{1}{2} [4 + 9 + 25] = 19$$

$$a^2 + b^2 + c^2 - ab - bc - ca = \frac{1}{2} [(a-b)^2 + (b-c)^2 + (c-a)^2]$$

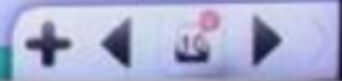
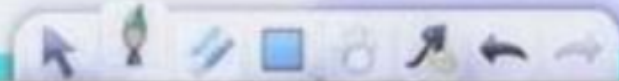
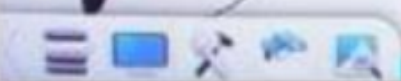
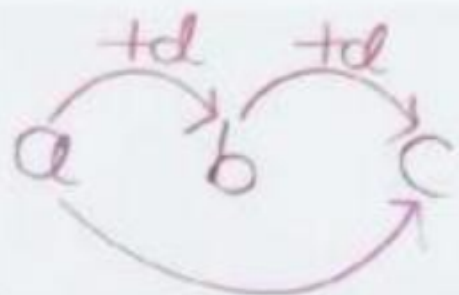
If a, b & c are in A.P with common difference ' d '

तो $a^2 + b^2 + c^2 - ab - bc - ca = \frac{1}{2} [d^2 + d^2 + 4d^2]$

$$= \frac{1}{2} \times 6d^2$$

$$= 3d^2$$

$$= 3 \times (\text{common difference})^2$$



$$a^2 + b^2 + c^2 - ab - bc - ca = \frac{1}{2} [(a-b)^2 + (b-c)^2 + (c-a)^2]$$

Example:-

If,

$$a = 71$$

$$b = 75$$

$$c = 79$$

$$d=4$$

$$\text{तो } a^2 + b^2 + c^2 - ab - bc - ca = 3 \times 4^2 = 48$$



34. If $a = 97.5$, $b = 100$, $c = 102.5$, then find $a^2 + b^2 + c^2 - ab - bc - ca = ?$

यदि $a = 97.5$, $b = 100$, $c = 102.5$ है, तो $a^2 + b^2 + c^2 - ab - bc - ca$ का मान ज्ञात कीजिए।

[A] $\frac{81}{4}$

[C] $\frac{75}{4}$ ✓

[B] $\frac{70}{4}$

[D] 15

$= 3 \times \left(\frac{5}{2}\right)^2$

$+2.5$ $+2.5$

35. If $p = 106$, $q = 105$ and $r = 104$, then the value of $p^2 + q^2 + r^2 - pq - qr - rp$ is?

यदि $p = 106$, $q = 105$ और $r = 104$, तो $p^2 + q^2 + r^2 - pq - qr - rp$ का मान क्या है?

(SSC SELECTION POST XII GRADUATE LEVEL)

[A] 2

[B] 0

[C] 1

[D] 3

3×1^2





If,

$$a^2 + b^2 + c^2 - ab - bc - ca = 0$$

or

$$a^2 + b^2 + c^2 = ab + bc + ca$$

तो



$$a = b = c$$

$$[(a - b)^2 + (b - c)^2 + (c - a)^2] = 0$$

0

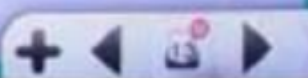
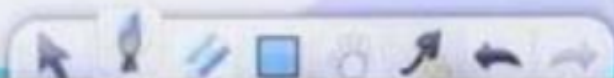
$$a = b$$

0

$$b = c$$

0

$$c = a$$



29. If a, b, c are non-zero real numbers, $abc = 27$ and $a^2 + b^2 + c^2 = ab + bc + ca$ then the value of $\frac{a^2 + 2b^2}{5c} = ?$

यदि a, b, c गैर-शून्य वास्तविक संख्या हैं, $abc = 27$ और $a^2 + b^2 + c^2 = ab + bc + ca$ तब $\frac{a^2 + 2b^2}{5c}$ का मान है?

$$\boxed{abc = 27}$$

$3 \times 3 \times 3$

$$\Rightarrow a = b = c = 3$$

[A] 1.6

[B] 1.5

[C] 1.8 ✓

[D] 1.4

$$= \frac{3a^2}{5a}$$

$$= \frac{3 \times 3}{5}$$

$$= 1.8$$

30. If $a^2 + b^2 + c^2 = ab + bc + ca$, then the value of $\frac{11a^4 + 13b^4 + 15c^4}{16a^2b^2 + 19b^2c^2 + 17c^2a^2}$ is:

यदि $a^2 + b^2 + c^2 = ab + bc + ca$, तो $\frac{11a^4 + 13b^4 + 15c^4}{16a^2b^2 + 19b^2c^2 + 17c^2a^2}$ का मान क्या है?

[A] $1\frac{3}{4}$
[C] $1\frac{1}{3}$

[B] $1\frac{1}{4}$
[D] $1\frac{3}{4}$

If,

$$a^2 + b^2 + c^2 - ab - bc - ca = 0$$

or

$$a^2 + b^2 + c^2 = ab + bc + ca$$

तो



$$a = b = c$$

30. If $a^2 + b^2 + c^2 = ab + bc + ca$, then the value of $\frac{11a^4 + 13b^4 + 15c^4}{16a^2b^2 + 19b^2c^2 + 17c^2a^2}$ is:

यदि $a^2 + b^2 + c^2 = ab + bc + ca$, तो $\frac{11a^4 + 13b^4 + 15c^4}{16a^2b^2 + 19b^2c^2 + 17c^2a^2}$ का मान क्या है?

[A] $1\frac{3}{4}$
[C] $1\frac{1}{3}$

[B] $\frac{1}{4}$
[D] $\frac{3}{4}$

$= \frac{39}{52}$
 $= \frac{3}{4}$

$\Rightarrow a = b = c$

31. If $x \neq 0$, $y \neq 0$ and $z \neq 0$ and $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{xy} + \frac{1}{yz} + \frac{1}{zx}$, then the relation among x, y, z is:

यदि $x \neq 0$, $y \neq 0$ और $z \neq 0$ हो, तथा $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{xy} + \frac{1}{yz} + \frac{1}{zx}$ हो, तो x, y और z के बीच संबंध है:

[A] $x + y + z = 0$

[B] $x + y = z$

[C] $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 0$

[D] $x = y = z$

$$\Rightarrow \frac{1}{x} = \frac{1}{y} = \frac{1}{z}$$

32. If $(a + b + c)^2 = 3(a^2 + b^2 + c^2)$, then which of the following is necessary true?

यदि $(a + b + c)^2 = 3(a^2 + b^2 + c^2)$, तो निम्न में से कौन सा आवश्यक सत्य है?

[A] $a \neq b = c$

[B] $a = b \neq c$

[C] $a = b = c$

[D] $a \neq b \neq c$

$$\cancel{a(b+c+a)} = \cancel{a^2+b^2+c^2}$$


33. If $x + y + z = 4\sqrt{6}$ and $x^2 + y^2 + z^2 = 32$, then $x:y:z=?$

यदि $x + y + z = 4\sqrt{6}$ और $x^2 + y^2 + z^2 = 32$, तो $x:y:z=?$

[A] 1:1:1

[B] 1:2:3

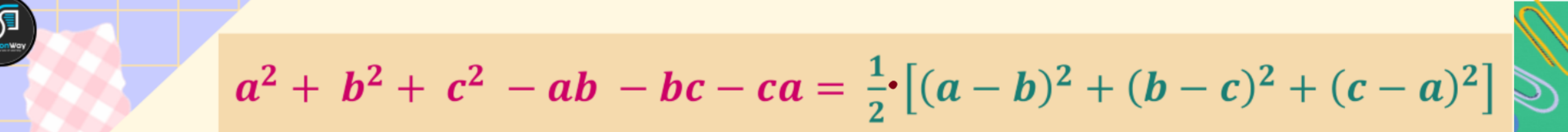
[C] 1:3:4

[D] 3:2:1

Special सवाल $\Rightarrow$

$$xy + yz + zx = \frac{(4\sqrt{6})^2 - 32}{2} = 32$$

$$x^2 + y^2 + z^2 = xy + yz + zx \Rightarrow x = y = z$$


$$a^2 + b^2 + c^2 - ab - bc - ca = \frac{1}{2} \cdot [(a - b)^2 + (b - c)^2 + (c - a)^2]$$



#

Concept →

$$a^3 + b^3 + c^3 - 3abc = (a + b + c) \cdot (a^2 + b^2 + c^2 - ab - bc - ca)$$

$$\frac{a^3 + b^3 + c^3 - 3abc}{a^2 + b^2 + c^2 - ab - bc - ca} = (a + b + c) \checkmark$$

$$a^3 + b^3 + c^3 - 3abc = \frac{1}{2}(a + b + c) \cdot [(a - b)^2 + (b - c)^2 + (c - a)^2]$$

$$\frac{a^3 + b^3 + c^3 - 3abc}{(a - b)^2 + (b - c)^2 + (c - a)^2} = \frac{a + b + c}{2} \checkmark$$



$$a^3 + b^3 + c^3 - 3abc = (a + b + c) \cdot (a^2 + b^2 + c^2 - ab - bc - ca) \times$$

$$= (a + b + c) \cdot \frac{1}{2} [(a - b)^2 + (b - c)^2 + (c - a)^2] \checkmark$$

$$\frac{a^3 + b^3 + c^3 - 3abc}{a^2 + b^2 + c^2 - ab - bc - ca} = a + b + c$$

$$\frac{a^3 + b^3 + c^3 - 3abc}{(a - b)^2 + (b - c)^2 + (c - a)^2} = \frac{a + b + c}{2}$$



if, $a = 150$

$b = 152$

$c = 155$

तो $a^3 + b^3 + c^3 - 3abc =$

$$\frac{1}{2}(a+b+c) \cdot [(a-b)^2 + (b-c)^2 + (c-a)^2]$$

$$= \frac{1}{2} \times 457 \times (4 + 9 + 25)$$

$$= 457 \times 19$$

Ans



$$a^2 + b^2 + c^2 - ab - bc - ca$$
$$= \frac{1}{2} \{ (a - b)^2 + (b - c)^2 + (c - a)^2 \}$$

**If a, b and c are in arithmetic
Progression, then**

$$a^2 + b^2 + c^2 - ab - bc - ca = 3d^2 \checkmark$$



$$a^3 + b^3 + c^3 - 3abc = (a + b + c) \cdot (a^2 + b^2 + c^2 - ab - bc - ca)$$

If a, b & c are in A.P with common difference 'd'

तो $a^3 + b^3 + c^3 - 3abc = 3b \times 3d^2 = 9bd^2$

$$= 9 \times \text{Middle no.} \times (\text{Common Diff})^2$$

Diagram illustrating the relationship between a, b, c in an Arithmetic Progression (A.P.) with common difference d :

$$\begin{array}{ccc} a & b & c \\ \uparrow & & \uparrow \\ +d & & +d \\ (b-d) & b & (b+d) \end{array}$$

trick



$$a^3 + b^3 + c^3 - 3abc = (a + b + c) \cdot (a^2 + b^2 + c^2 - ab - bc - ca)$$

$$= (a + b + c) \cdot \frac{1}{2} [(a - b)^2 + (b - c)^2 + (c - a)^2]$$

Example:-

If,

$$a = 71$$

$$b = 75$$

$$c = 79$$

$$d = 4$$

तो $a^3 + b^3 + c^3 - 3abc = ?$ $9 \times 75 \times 4^2$

$$= 9 \times 1200$$

$$= 10800$$



38. Factorize the given algebraic expression.
दिए गए बीजीय व्यंजक का गुणनखंड कीजिए।

$$x^3 + 27y^3 + 64z^3 - 36xyz$$

[A] $(x + 3y + 4z)(x^2 + 9y^2 + 16z^2 + 3xy + 12yz + 4xz)$

[B] $(x + 3y + 4z)(x^2 + 9y^2 + 16z^2 - 12xy - 3yz - 4xz)$

[C] $(x - 3y - 4z)(x^2 + 9y^2 + 16z^2 - 3xy - 12yz - 4xz)$

[D] $(x + 3y + 4z)(x^2 + 9y^2 + 16z^2 - 3xy - 12yz - 4xz)$

$$(x)^3 + (3y)^3 + (4z)^3 - 3x \cdot 3y \cdot 4z$$

39. $(2x + 3y + 4z) \cdot (4x^2 + 9y^2 + 16z^2 - 6xy - 12yz - 8xz) = ?$

[A] $8x^3 - \cancel{27y^3} - \cancel{64z^3} - 72xyz$

[B] $8x^3 + 27y^3 - \cancel{64z^3} + 72xyz$

[C] $8x^3 + 27y^3 + 64z^3 + \cancel{72xyz}$

[D] $8x^3 + 27y^3 + 64z^3 - 72xyz$ ✓

$a \rightarrow 2x$

$b \rightarrow 3y$

$c \rightarrow 4z$

40. Simplify $\frac{8x^3 + 27y^3 - 64z^3 + 72xyz}{4x^2 + 9y^2 + 16z^2 - 6xy + 12yz + 8zx}$.

$\frac{8x^3 + 27y^3 - 64z^3 + 72xyz}{4x^2 + 9y^2 + 16z^2 - 6xy + 12yz + 8zx}$ को सरल कीजिए।

(RRB NTPC GRADUATE LEVEL 2025)

[A] $(2x - 3y + 4z)$

[B] $(2x + 3y - 4z)$

[C] $(2x + 3y + 4z)$

[D] $(2x - 3y - 4z)$

$$\frac{(2x)^3 + (3y)^3 + (-4z)^3 - 3 \times 2x \times 3y \times (-4z)}{4x^2 + 9y^2 + 16z^2 - 6xy + 12yz + 8zx}$$

41. Which of the following is a factor of $3\sqrt{3}x^3 + 2\sqrt{2}y^3 - 18xy + 6\sqrt{6}$?
 निम्नलिखित में से कौन सा $3\sqrt{3}x^3 + 2\sqrt{2}y^3 - 18xy + 6\sqrt{6}$ का गुणनखंड है?
 (CDS 2023)

[A] ~~$\sqrt{3}x + \sqrt{2}y - \sqrt{3}$~~

[B] ~~$\sqrt{3}x + \sqrt{2}y - \sqrt{6}$~~

✓ [C] $3x^2 + 2y^2 - \sqrt{18}x - \sqrt{12}y - \sqrt{6}xy + 6$

[D] ~~$3x^2 + 2y^2 + \sqrt{18}x + \sqrt{12}y - \sqrt{6}xy + 6$~~

$$(\sqrt{3}x)^3 + (\sqrt{2}y)^3 + (\sqrt{6})^3 - 3 \times \sqrt{3}x \times \sqrt{2}y \times \sqrt{6}$$

42. If $a = 500$, $b = 502$ and $c = 504$, then the value of $a^3 + b^3 + c^3 - 3abc$?

यदि $a = 500$, $b = 502$ और $c = 504$ है, तो $a^3 + b^3 + c^3 - 3abc$ का मान क्या होगा?

[A] 15060

[B] 12048

[C] 18072 ✓

[D] 17040

$$= 9 \times 500 \times 2^2$$

43. If $(321)^3 + (325)^3 + (329)^3 - (321)(329)(975) = ?$

यदि $(321)^3 + (325)^3 + (329)^3 - 3(321)(329)(325) = ?$

[A] 46800

[B] ~~46150~~

[C] 40860

[D] ~~48900~~

$$d=4$$

$$= 9 \times 325 \times 4^2$$

$$\div 25$$

44. If $x = 222$, $y = 222$, $z = 225$, then find $x^3 + y^3 + z^3 - 3xyz = ?$

यदि $x = 222$, $y = 222$, $z = 225$ है, तो $x^3 + y^3 + z^3 - 3xyz$ का मान ज्ञात कीजिए।

[A] 4950

[B] 5994

[C] 4683

[D] 6021

$$= \frac{1}{2} \times 669 \times [0 + 9 + 9]$$

$$= 669 \times 9$$

45. Find $\frac{(1205)^3 + (1207)^3 + (1209)^3 - 3(1205)(1207)(1209)}{3621}$?

$\frac{(1205)^3 + (1207)^3 + (1209)^3 - 3(1205)(1207)(1209)}{1205 + 1207 + 1209}$ ज्ञात कीजिये?

[A] 22

[B] 18

[C] 9

[D] 12 ✓

$$= a^3 + b^3 + c^3 - 3abc = 3 \times 2^3 = 12$$

$$d = 2$$

46. If $a = 225$, $b = 197$ and $c = 178$, then find $\frac{a^3 + b^3 + c^3 - 3abc}{(a-b)^2 + (b-c)^2 + (c-a)^2} = ?$

यदि $a = 225$, $b = 197$ और $c = 178$ है, तो $\frac{a^3 + b^3 + c^3 - 3abc}{(a-b)^2 + (b-c)^2 + (c-a)^2}$ का मान ज्ञात कीजिए।

[A] 122

[C] 200

[B] 300

[D] 159

$$= \frac{a+b+c}{2}$$

$$= \frac{600}{2}$$

47. If $a = 356$, $b = -189$ and $c = -163$, then find the value of $\frac{(a-b)^2 + (b-c)^2 + (c-a)^2}{a^3 + b^3 + c^3 - 3abc}$.

यदि $a = 356$, $b = -189$ और $c = -163$, तो $\frac{(a-b)^2 + (b-c)^2 + (c-a)^2}{a^3 + b^3 + c^3 - 3abc}$ का मान क्या है?

[A] 2

[C] 1

[B] 0.5

[D] 4

$$= \frac{2}{a+b+c}$$

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

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

48. If $(p - q) = 6$ and $(r - q) = 5$, find the value of $(p^3 + q^3 + r^3 - 3pqr)/(p + q + r)$.
 यदि $(p - q) = 6$, $(r - q) = 5$, तो $(p^3 + q^3 + r^3 - 3pqr)/(p + q + r)$ का मान ज्ञात कीजिए।

SSC CHSL TIER - I 2022

[A] 45

[C] 31 ✓

[B] 40

[D] 30

$$= \frac{1}{2} [(p-q)^2 + (q-r)^2 + (r-p)^2]$$

$$(p-q) - (r-q) = 6 - 5$$

$$p - r = 1$$

$$= \frac{1}{2} \times [36 + 25 + 1]$$

$$= 31$$