Greetings !

Dear students in the previous notes we learn the concept of Multiplication of algebraic expressions, in this notes we will learn the concept of Division of algebraic expressions.

Division of Algebraic Expressions

In the previous sessions, we have learnt how to add, subtract and multiply algebraic expressions. Now, we are going to learn about another basic operation **'division'** on algebraic expressions. We know that the division is the reverse operation of multiplication.

Now, the cost of 10 balls at the rate of Rs 5 each = 10 x 5 = Rs 50

whereas if we have `50 and we want to buy 10 balls then,

the cost of each ball is = $\frac{50}{10}$ = Rs 5

What we have seen above is division on numbers. But how will you divide an algebraic expression by another algebraic expression?

Of course, the same procedure has to be followed for the algebraic expressions with the help of laws of exponents.

If x is a variable and m, n are constants, then $x^m \div x^n = x^{m-n}$ where $m > n$.

Division of a monomial by another monomial

Dividing a monomial $10\,p^4$ by another monomial $2\,p^3$, we get

$10p^4 \div 2p^3$

$$\frac{10p^4}{2p^3} = \frac{\overset{5}{\cancel{10}} \times p \times \cancel{p} \times \cancel{p} \times \cancel{p}}{\cancel{2} \times \cancel{p} \times \cancel{p} \times \cancel{p}} \text{ (expansion of power)}$$

$=5p$

However, to divide we can also follow laws of exponents as,

$$\frac{\overset{5}{\cancel{10}}p^4}{\cancel{2}p^3} = 5p^{4-3}$$

$$= 5p$$

$$\frac{x^m}{x^n} = x^{m-n}$$

Example 3.6

Velu pastes ' 4xy ' pictures in one page of his scrap book. How many pages will he need to paste 100 x^2 y^3 pictures? (x, y are positive integers)

Solution:

Total number of pictures = 100 x^2 y^3

Pictures in one page = 4xy

$$\text{Total number of pages needed} = \frac{\text{Total number of pictures}}{\text{pictures in one page}}$$

$$= \frac{\overset{25}{\cancel{100}}x^2y^3}{\cancel{4}xy} = 25x^{2-1}y^{3-1}$$

$= 25xy^2$ pages

Division of an algebraic expression (polynomial) by a monomial

To divide a polynomial by a monomial, divide each term of the polynomial by the monomial.

Example 3.7

Divide : $(5y^3 - 25y^2 + 8y)$ by $5y$

Solution:

We have, $(5y^3 - 25y^2 + 8y) \div 5y$

$$= \frac{5y^3 - 25y^2 + 8y}{5y}$$

$$= \frac{\cancel{5}y^3}{\cancel{5}y} - \frac{\overset{5}{\cancel{25}}y^2}{\cancel{5}y} + \frac{8y}{5y}$$

$$= y^{3-1} - 5y^{2-1} + \frac{8}{5}$$

$$= y^2 - 5y + \frac{8}{5}$$

Now we are enter into exercise problems

Exercise 3.2

Question 1.

Fill in the blanks

(i) $\frac{18m^4(\_\_\_)}{2m^3n^3} = \_\_\_\_\_ mn^5.$

Answer:

$\frac{18m^4(n^8)}{2m^{(3)}n^3} = 9\ mn^5$

(ii) $\frac{l^4m^5n^{(\ )}}{2lm^{(\ )}n^6} = \frac{l^3m^3n}{2}.$

Answer:

$\frac{l^4m^5n^{(7)}}{2lm^{(3)}n^6} = \frac{l^3m^2n}{2}$

(iii) $\frac{42a^2b^5(\_\_)}{6a^4b^2} = (\_\_\_\_)b^3c^2.$

Answer:

$\frac{42a^4b^5(c^2)}{6(a)^4(b)^2} = (7)b^3c^2$

Question 2.

Say True or False

(i) $8x^3y \div 4x^2 = 2xy$

Answer:

True

(ii) $7ab^3 \div 14\ ab = 2b^2$

Answer:

False

Question 3.

Divide

(i) 27 y^3 by 3y

(ii) x^3 y^2 by x^2y

(iii) 45x^3 y^2 z^4 by (-15 xyz)

(iv) $(3xy)^2$ by 9xy

Answer:

(i) 27 y^3 by 3y

$\frac{27y^3}{3y} = \frac{27}{3}y^{3-1} = 9y^2$

(ii) x^3 y^2 by x^2y

$\frac{x^3y^2}{x^2y} = x^{3-2}\, y^{2-1} = x^1\, y^1 = xy$

(iii) 45x^3 y^2 z^4 by (-15 xyz)

$\frac{45x^3y^2z^4}{-15xyz} = \frac{45}{-15}\, x^{3-2}\, y^{2-1}\, y^{4-1}\, z^{4-1} = -3x^2\, yz^3$

(iv) $(3xy)^2$ by 9xy

$\frac{(3xy)^2}{3\times(3xy)} = \frac{(3xy)^2}{3\times(3xy)} = \frac{1}{3}\,(3xy)^{2-1} = \frac{1}{3}\,3xy = xy$

Question 4.

Simplify

(i) $\frac{3m^2}{m} + \frac{2m^4}{m^3}$

(ii) $\frac{14p^5q^3}{2p^2q}\,\frac{12p^3q^4}{3q^2}$

Answer:

(i) $\frac{3m^2}{m} + \frac{2m^4}{m^3}$

$\frac{3m^2}{m} + \frac{2m^4}{m^3} = 3m^{2-1} + 2m^{4-3}$

$= 3m + 2m$

$= (3 + 2)\, m$

$= 5m$

(ii) $\frac{14p^5q^3}{2p^2q}\,\frac{12p^3q^4}{3q^2}$

$\frac{14p^5q^3}{2p^2q}\,\frac{12p^3q^4}{3q^2} = \frac{14}{2}p^{5-2}q^{3-1} - \frac{12}{3}\,p^3q^{4-3}$

$= 7p^3q^2 - 4p^3q$

Question 5.

Divide:

(i) $32y^2 - 8yz$ by $2y$

(ii) $(4m^2n^3 + 16m^4 n^2 - mn)$ by $2mn$

(iii) $5xy^2 - 18x^2y^3 + 6xy$ by $6xy$

(iv) $81(p^4 q^2 r^3 + 2p^3q^3 r^2 - 5p^2q^2r^2)$ by $(3pqr)^2$

Answer:

(i) $32y^2 - 8yz$ by $2y$

$$\frac{32y^2 - 8yz}{2y} = \frac{32y^2}{2y} - \frac{8yz}{2y} = \frac{32}{2}y^{2-1} - \frac{8}{2}y^{1-1}z = 16y - 4z$$

(ii) $(4m^2n^3 + 16m^4 n^2 - mn)$ by $2mn$

$$\frac{4m^2n^3 + 16m^4n^2 - mn}{2mn} = \frac{4m^2n^3}{2mn} + \frac{16m^4n^2}{2mn} - \frac{mn}{2mn}$$

$$= \frac{4}{2}m^{2-1}n^{3-1} + \frac{16}{2}m^{4-1}n^{2-1} - \frac{1}{2}m^{1-1}n^{1-1}$$

$$= 2m^1 n^2 + 8\, m^3\, n^1 - \frac{1}{2}m^0 n^0$$

$$= 2mn^2 + 8\, m^3\, n - \frac{1}{2}$$

(iii) $5xy^2 - 18x^2y^3 + 6xy$ by $6xy$

$$\frac{5xy^2 - 18x^2y^3 + 6xy}{6xy} = \frac{xy\left(5y - 18xy^2 + 6\right)}{6xy}$$

$$= \frac{5y - 18xy^2 + 6}{6}$$

(iv) $81(p^4 q^2 r^3 + 2p^3q^3 r^2 - 5p^2q^2r^2)$ by $(3pqr)^2$

$$\frac{81(p^4q^2r^3 + 2p^3q^3r^2 - 5p^2q^2r^2)}{(3pqr)^2}$$

$$= \frac{81(p^2q^2r^2)(p^2r + 2pq - 5)}{9(p^2q^2r^2)}$$

$= \frac{81}{9}(p^2q^2r^2)^{1-1}\,(p^2r + 2pq - 5)$

$= 9(p^2r + 2pq - 5) = 9\,p^2r + 18pq - 45$

Question 6.

Identify the errors and correct them.

(i) $7y^2 – y^2 + 3y^2 = 10y^2$

Answer:

$7y^2 – y^2 + 3y^2 = 10y^2 = (7 – 1 + 3)y^2$

$= (6 + 3)y^2$

$= 9y^2$

(ii) $6xy + 3xy = 9x^2y^2$

Answer:

$6xy + 3xy = (6 + 3)\ xy$

$= 9\ xy$

(iii) $m(4m – 3) = 4m^2 – 3$

Answer:

$m(4m – 3) = m(4m) + m(-3)$

$= 4m^2 – 3m$

(iv) $(4n)^2 – 2n + 3 = 4n^2 – 2n + 3$

Answer:

$(4n)^2 – 2n + 3 = 16n^2 – 2n + 3$

(v) $(x – 2)(x + 3) = x^2 – 6$

Answer:

$(x – 2)(x + 3) = x(x + 3) – 2\ (x + 3)$

$= x(x) + (x) \times 3 + (-2)\ (x) + (-2)\ (3)$

$= x^2 + 3x – 2x – 6$

$= x^2 + x – 6$

(vi) $-3p^2 + 4p – 7 = -(3p^2 + 4p – 7)$

Answer:

$-3p^2 + 4p – 7 = -(3p^2 – 4p + 7)$

@@@@@ **Thank you** @@@@