

10TH MATHS ALGEBRA VERY IMPORTANT QUESTION ANSWERS

Find the LCM of the given expressions.

$$4x^2y, 8x^3y^2$$

Answer : $4x^2y, 8x^3y^2$

$$\text{LCM of } (4, 8) = 8$$

$$\text{LCM of } (x^2y, x^3y^2) = x^3y^2$$

$$\text{LCM of } (4x^2y, 8x^3y^2) = 8x^3y^2$$

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Reduce each of the following rational expressions to its lowest form.

$$\frac{x^2-1}{x^2+x}$$

Answer : $\frac{x^2-1}{x^2+x} = \frac{(x+1)(x-1)}{x(x+1)} = \frac{x-1}{x}$

Find the excluded values, if any of the following expressions.

$$\frac{y}{y^2-25}$$

Answer : $\frac{y}{y^2-25} = \frac{y}{(y+5)(y-5)}$ is undefined when $(y+5)(y-5)=0$ that is $y=-5,5$.

∴ The excluded values are -5,5.

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Find the square root of the following

$$4x^2 + 20x + 25$$

Answer : $|2x + 5|$

Find the zeroes of the quadratic expression $x^2 + 8x + 12$

Answer : Let $p(x) = x^2 + 18x + 12 = (x + 2)(x + 6)$

$$p(-2) = 4 - 16 + 20 = 0$$

$$p(-6) = 36 - 48 + 12 = 0$$

Therefore -2 and -6 are zero of $p(x) = x^2 + 8x + 12$

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Solve $2x^2 - 3x - 3 = 0$ by formula method.

Answer : Compare $2x^2 - 3x - 3 = 0$ with the standard form $ax^2 + bx + c = 0$

$$a = 2, b = -3, c = -3$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

substituting the values of a, b and c in the formula we get,

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-3)}}{2(2)} = \frac{3 \pm \sqrt{33}}{4}$$

$$\text{Therefore } x = \frac{3 + \sqrt{33}}{4}, x = \frac{3 - \sqrt{33}}{4}$$

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Find the values of 'k', for which the quadratic equation $kx^2 - (8k + 4)x + 81 = 0$ has real and equal roots?

Answer : $kx^2 - (8k + 4)x + 81 = 0$

Since the equation has real and equal roots, $\Delta = 0$

That is, $b^2 - 4ac = 0$

Here, $a = k$, $b = -(8k + 4)$, $c = 81$

That is, $[-(8k + 4)]^2 - 4(k)(81) = 0$

$$64k^2 + 64k + 16 - 324k = 0$$

$$64k^2 - 260k + 16 = 0$$

dividing by 4 we get $16k^2 - 65k + 4 = 0$

$$(16k - 1)(k - 4) = 0 \text{ then, } k = \frac{1}{16} \text{ or } k = 4$$

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188) If α, β are the roots of the equation $3x^2 + 7x - 2 = 0$, find the values of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$

Answer : $3x^2 + 7x - 2 = 0$ here, $a = 3, b = 7, c = -2$

since, α, β are the roots of the equation

$$\alpha + \beta = \frac{-b}{a} = \frac{-7}{3}, \alpha\beta = \frac{c}{a} = \frac{-2}{3}$$

$$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta} = \frac{\left(\frac{-7}{3}\right)^2 - 2\left(\frac{-2}{3}\right)}{\frac{-2}{3}} = \frac{-61}{6}$$

242) Simplify

$$\frac{x^3}{x-y} + \frac{y^3}{y-x}$$

Answer : $\frac{x^3}{x-y} + \frac{y^3}{y-x} = \frac{x^3}{x-y} - \frac{y^3}{y-x} = \frac{x^3 - y^3}{(x-y)}$

$$= \frac{(x-y)(x^2 + xy + y^2)}{x-y}$$
$$x^2 + xy + y^2$$

192) If one root of the equation $2y^2 - ay + 64 = 0$ is twice the other then find the values of a.

Answer : Let one of the root $\alpha = 2\beta$

$$\alpha + \beta = 2\beta + \beta = 3\beta$$

Given

$$2y^2 - ay + 64 = 0$$

$$y^2 = \frac{a}{2}y + 32 = 0$$

$$\Rightarrow y^2 - \left(\frac{a}{2}\right)y + 32 = 0$$

$$\text{Sum of the roots } \alpha + \beta = \frac{a}{6}$$

$$\text{i.e } 3\beta = \frac{a}{2} \Rightarrow \beta = \frac{a}{6}$$

$$\alpha\beta = \alpha \times \frac{a}{6}$$

$$\Rightarrow 2\beta \times \beta = 2 \left(\frac{a}{6}\right) \left(\frac{a}{6}\right)$$

$$a^2 = 576$$

$$a = 24, -24$$

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193) If one root of the equation $3x^2 + kx + 81 = 0$ (having real roots) is the square of the other then find k.

Answer : $3x^2 + kx + 81 = 0$

Let the roots be α and α^2

$$\alpha + \alpha^2 = \frac{-k}{3} \dots(1)$$

$$\alpha + \alpha^2 = \frac{81}{3}$$

$$\Rightarrow k^3 = 27$$

$$\Rightarrow k^3 = 3 \dots(3)$$

$$3 + 3^2 = \frac{-k}{3}$$

$$\Rightarrow (3 + 9)3 = -k$$

$$\Rightarrow k = -36.$$

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222) Find the LCM of the given expressions.
 $(2x^2 - 3xy)^2, (4x - 6y)^3, 8x^3 - 27y^3$

Answer : $(2x^2 - 3xy)^2 = (x(2x - 3y))^2$

$$= x(2x - 3y)^2$$

$$(4x - 6y)^3 = (2(2x - 3y))^3$$

$$2^3(2x - 3y)^3$$

$$8x^3 - 27y^3 = (2x)^3 - (3y)^3$$

$$= (2x - 3y)(4x^2 + 6xy + 9y^2)$$

$$= (2x - 3y)(4x^2 + 6xy + 9y^2)$$

$$\text{L.C.M} = 2^3x^2(2x - 3y)^3(4x^2 + 6xy + 9y^2)$$

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227) Find the LCM and GCD for the following and verify that $f(x) \times g(x) = \text{LCM} \times \text{GCD}$
 $(x^2y + xy^2), (x^2 + xy)$

Answer : $f(x) = x^2y + xy^2 = xy(x + y)$

$$g(x) = x^2 + xy = x(x + y)$$

$$\text{L.C.M.} = xy(x + y)$$

$$\text{G.C.D.} = x(x + y)$$

$$f(x) \times g(x) = (x^2y + xy^2)(x^2 + xy)$$

$$= xy(x + y) \times (x + y)$$

$$= x^2y(x + y)^2$$

$$\text{L.C.M} \times \text{G.C.D.} = xy(x + y)x(x + y)$$

$$= x^2y(x + y)^2$$

$$f(x) \times g(x) = \text{L.C.M.} \times \text{G.C.D.}$$

Hence verified.

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246) Find the square root of the following polynomials by division method $16x^4 + 8x^2 + 1$

Answer : $\sqrt{16x^4 + 8x^2 + 1}$

$$\begin{array}{r}
 4x^2 + 0x + 1 \\
 \hline
 4x^2 \overline{) 16x^4 + 0x^3 + 8x^2 + 0x + 1} \\
 \underline{(-) 16x^4} \\
 0x^3 + 8x^2 \\
 \underline{0x^3 + 0x^2} \\
 8x^2 + 0x + 1 \\
 \underline{(-) 8x^2 + 0x + 1} \\
 0
 \end{array}$$

$\therefore \sqrt{16x^4 + 8x^2 + 1} = 4x^2 + 1$

249) Find the sum and product of the roots for each of the following quadratic equations:
 $2x^2 + 5x + 7 = 0$

Answer : $2x^2 + 5x + 7 = 0$

$a = 2, b = 5, c = 7$

$\alpha + \beta = -\frac{b}{a} = -\frac{5}{2}$ and $\alpha\beta = \frac{c}{a} = \frac{7}{2}$

$\alpha + \beta = -\frac{5}{2}; \alpha\beta = \frac{7}{2}$

263) Determine the nature of roots for the following quadratic equations
 $9x^2 - 24x + 16 = 0$

Answer : $9x^2 - 24x + 16 = 0$

Here, $a = 9$, $b = -24$, $c = 16$

Now, $\Delta = b^2 - 4ac = (-24)^2 - 4(9)(16) = 0$

Here, $\Delta = 0$. So, the equation will have real and equal roots

264) Determine the nature of roots for the following quadratic equations
 $2x^2 - 2x + 9 = 0$

Answer : $2x^2 - 2x + 9 = 0$

Here, $a = 2$, $b = -2$, $c = 9$

Now, $\Delta = b^2 - 4ac = (-2)^2 - 4(2)(9) = -68$

Here, $\Delta = -68 < 0$. So, the equation will have no real roots.

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265) Determine the nature of the roots for the following quadratic equations
 $x^2 - x - 1 = 0$

Answer : $x^2 - x - 1 = 0$, Here $a = 1$, $b = -1$, $c = -1$

$$\Delta = b^2 - 4ac = (-1)^2 - 4 \times 1 \times -1$$

$$= 1 + 4$$

$$= 5 > 0$$

$\therefore$ The roots are real and unequal

273) If α and β are the roots of $x^2 + 7x + 10 = 0$ find the values of
 $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$

Answer : $x^2 + 7x + 10$ here, $a = -1$, $b = 7$, $c = 10$

if α and β are roots of the equation then,

$$\alpha + \beta = \frac{-b}{a} = \frac{-7}{1} = -7; \alpha\beta = \frac{c}{a} = \frac{10}{1} = 10$$

$$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta} = \frac{49 - 20}{10} = \frac{29}{10}$$

275) If α, β are the roots of the equation $3x^2 + 7x - 2 = 0$, find the values of $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$

Answer : $3x^2 + 7x - 2 = 0$ here, $a = 3, b = 7, c = -2$
since, α, β are the roots of the equation

$$\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha} = \frac{\alpha^3 + \beta^3}{\alpha\beta} = \frac{(\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)}{\alpha\beta} = \frac{\left(-\frac{7}{3}\right)^3 - 3\left(-\frac{2}{3}\right)\left(-\frac{7}{3}\right)}{-\frac{7}{3}} = \frac{469}{18}$$

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1) Solve $\frac{1}{3}(x + y - 5) = y - z = 2x - 11 = 9 - (x + 2z)$.

Answer : $\frac{1}{3}(x + y - 5) = y - z$

$$x + y - 5 = 3y - 3z$$

$$x - 2y + 3z = 5 \quad \dots\dots\dots(1)$$

$$y - z = 2x - 11$$

$$2x - y + z = 11 \quad \dots\dots\dots(2)$$

$$2x - 11 = 9 - (x + 2z)$$

$$2x + x + 2z = 9 + 11$$

$$3x + 2z = 20 \quad \dots\dots\dots(3)$$

Substituting $x = 6, z = 1$ is

$$6 - 2y + 3(1) = 5$$

$$6 + 3 - 5 = 2y$$

$$4 = 2y$$

$$Y = 2y$$

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

Solution: $x = 6, y = 2, z = 1$.

Consider (1) and (2)

$$(2) \times 2 \Rightarrow 4x - 2y + 2z = 22 \quad \dots (4)$$

$$(4) - (1) \Rightarrow \frac{x - 2y + 3z = 5}{3x - z = 17} \quad \dots(5)$$

Now, consider (3) and (5)

$$3x + 2z = 20 \quad \dots(3)$$

$$3x - z = 17 \quad (5)$$

$$(3) - (5) \Rightarrow \frac{3z = 3}{3z = 3}$$

$$z = 3/3 = 1$$

Substituting $z = 1$ in (3)

$$3x + 7(1) = 20$$

$$3x = 20 - 7 = 13$$

$$x = \frac{13}{3} = 4\frac{1}{3}$$

$\dots\dots\dots(1)$

- 5) Find the GCD of the following by division algorithm $2x^4 + 13x^3 + 27x^2 + 23x + 7$, $x^3 + 3x^2 + 3x + 1$, $x^2 + 2x + 1$

Answer : Let $f(x) = 2x^4 + 13x^3 + 27x^2 + 23x + 7$,

$$g(x) = x^3 + 3x^2 + 3x + 1,$$

$$h(x) = x^2 + 2x + 1$$

which is the least degree polynomial.

Now Dividing $f(x)$ by $h(x)$

$x^2 + 2x + 1$	$2x^2 + 9x + 7$	
$2x^4 + 13x^3 + 27x^2 + 23x + 7$	$2x^4 + 4x^3 + 2x^2$	(-)
$9x^3 + 25x^2 + 23x$	$9x^3 + 18x^2 + 9x$	(-)
$7x^2 + 14x + 7$	$7x^2 + 14x + 7$	(-)
0		

Since the Remainder is zero, $h(x)$ is the GCD of $f(x)$ and $h(x)$

Now, dividing $g(x)$ by $h(x)$

$x^2 + 2x + 1$	$x + 1$	
$x^3 + 3x^2 + 3x + 1$	$x^3 + 2x^2 + x$	(-)
$x^2 + 2x + 1$	$x^2 + 2x + 1$	(-)
0		

Remainder is zero, $h(x)$ is the GCD of $g(x)$ and $h(x)$

$h(x)$ divides both $f(x)$ and $g(x)$ completely

$$\text{GCD} = x^2 + 2x + 1$$

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9) Find the square root of $289x^4 - 612x^3 + 970x^2 - 684x + 361$

Answer : $17x^2 - 18x + 19$

$17x^2$	$ \begin{array}{r} 17x^2 - 18x + 19 \\ \hline 289x^4 - 612x^3 + 970x^2 - 684x + 361 \\ \underline{289x^4} \\ (-) \\ \hline -612x^3 + 970x^2 \\ \underline{(+) + 324x^2} \\ (-) \\ \hline 646x^2 - 684x + 361 \\ \underline{(-) + 361} \\ (-) \\ \hline 0 \end{array} $
---------	---

$|17x^2 - 18x + 19|$

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30) Discuss the nature of solutions of the following system of equations
 $x + 2y - z = 6$; $-3x - 2y + 5z = -12$; $x - 2z = 3$

Answer : $x + 2y - z = 6$... (1)

$-3x - 2y + 5z = -12$ (2)

$x - 2z = 3$ (3)

Consider (1) and (3)

$$\begin{array}{rcl} x + 2y - z & = & 6 \quad \dots (1) \\ x & - & 2z = 3 \quad (-) \quad \dots (3) \\ \hline (1) - (3) \Rightarrow & 2y + z & = 3 \quad \dots (4) \end{array}$$

Consider (4) and (2)

$$\begin{array}{rcl} 2y + z & = & 3 \quad \dots (4) \\ -3x - 2y + 5z & = & -12 \quad (+) \quad \dots (2) \\ \hline (4) + (2) \Rightarrow & -3x + 6z & = -9 \quad \dots (5) \end{array}$$

Dividing equation (5) by (-3)
We get, $x - 2z = 3$... (6)

Now consider (6) and (3)

$$\begin{array}{rcl} x - 2z & = & 3 \quad \dots (6) \\ x - 2z & = & 3 \quad \dots (3) \\ \hline (6) - (3) \Rightarrow & 0 & = 0 \text{ which is an Identity.} \end{array}$$

The system of equations has infinitely many solutions

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35) Find the GCD of $6x^3 - 30x^2 + 60x - 48$ and $3x^3 - 12x^2 + 21x - 18$.

Answer : Let, $f(x) = 6x^3 - 30x^2 + 60x - 48 = 6(x^3 - 5x^2 + 10x - 8)$ and $g(x) = 3x^3 - 12x^2 + 21x - 18 = 3(x^3 - 4x^2 + 7x - 6)$

Now, we shall find the GCD of $x^3 - 5x^2 + 10x - 8$ and $x^3 - 4x^2 + 7x - 6$

$$\begin{array}{r} x^3 - 5x^2 + 10x - 8 \quad \overline{) \quad \begin{array}{l} 1 \\ x^3 - 4x^2 + 7x - 6 \\ \hline x^3 - 5x^2 + 10x - 8 \end{array}} \quad (-) \\ \hline x^2 - 3x + 2 \end{array}$$

$$\begin{array}{r} x^2 - 3x + 2 \quad \overline{) \quad \begin{array}{l} x - 2 \\ x^3 - 5x^2 + 10x - 8 \\ \hline x^3 - 3x^2 + 2x \\ \hline -2x^2 + 8x - 8 \\ \hline -2x^2 + 6x - 4 \\ \hline 2x - 4 \\ \hline = 2(x - 2) \end{array}} \quad (-) \\ \hline \end{array}$$

$$\begin{array}{r} x - 2 \quad \overline{) \quad \begin{array}{l} x - 1 \\ x^2 - 3x + 2 \\ \hline x^2 - 2x \\ \hline -x + 2 \\ \hline -x + 2 \\ \hline 0 \end{array}} \quad (-) \\ \hline \end{array}$$

Here, we get zero as remainder.

GCD of leading coefficients 3 and 6 is 3.

Thus, $\text{GCD} [(6x^3 - 30x^2 + 60x - 48, 3x^3 - 12x^2 + 21x - 18)] = 3(x - 2)$.

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38) Find the GCD of each pair of the following polynomials
 $12(x^4 - x^3)$, $8(x^4 - 3x^3 + 2x^2)$ whose LCM is $24x^3 (x - 1) (x - 2)$

Answer : Let $f(x) = 12(x^4 - x^3)$

$$= 12x^3 (x - 1)$$

$$g(x) = 8(x^4 - 3x^3 + 2x^2)$$

$$= 8x^2 (x^2 - 3x + 2)$$

$$= 8x^2 (x - 1) (x - 2)$$

$$\text{Given LCM} = 24x^3 (x - 1) (x - 2)$$

$$\text{We know } f(x) \times g(x) = \text{LCM} \times \text{GCD}$$

$$\therefore \text{GCD} = \frac{f(x) \times g(x)}{\text{LCM}}$$
$$= \frac{12x^3(x-1) \times 8x^2(x-1)(x-2)}{24x^3(x-1)(x-2)}$$

$$\text{GCD} = 4x^2 (x - 1)$$

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43) If $x = \frac{a^2+3a-4}{3a^2-3}$ and $y = \frac{a^2+2a-8}{2a^2-2a-4}$ find the value of x^2y^{-2}

Answer : $x = \frac{a^2+3a-4}{3a^2-3}$, $y = \frac{a^2+2a-8}{2a^2-2a-4}$

$$x^2y^2 = \left(\frac{a^2+3a-4}{3a^2-3} \right) \left(\frac{a^2+3a-4}{3a^2-3} \right) \times \left(\frac{2a^2-2a-4}{a^2+2a-8} \right)$$

$$= \frac{\cancel{(a+4)} \cancel{(a-1)}}{3 \cancel{(a+1)} \cancel{(a-1)}} \times \frac{\cancel{(a+4)} \cancel{(a-1)}}{3 \cancel{(a+1)} \cancel{(a-1)}} \\ \times \frac{2 \cancel{(a-2)} \cancel{(a+1)} 2 \cancel{(a-2)} \cancel{(a+1)}}{\cancel{(a+4)} \cancel{(a-2)} \cancel{(a+4)} \cancel{(a-2)}}$$

$$= \frac{4}{9}$$

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49) If $A = \frac{2x+1}{2x-1}$, $B = \frac{2x-1}{2x+1}$ find $\frac{1}{A-B} - \frac{2B}{A^2-B^2}$

Answer : $A = \frac{2x+1}{2x-1}$, $B = \frac{2x-1}{2x+1}$

$$\frac{1}{A-B} - \frac{2B}{A^2-B^2} = \frac{A+B-2B}{(A+B)(A-B)}$$

$$= \frac{(A-B)}{(A+B)} = \frac{1}{A+B}$$

$$= \frac{1}{\frac{2x+1}{2x-1} + \frac{2x-1}{2x+1}} = \frac{1}{\frac{(2x+1)^2 + (2x-1)^2}{(2x-1)(2x+1)}}$$

$$= \frac{1}{\frac{4x^2 + 4x + 1 + 4x^2 + 4x + 1}{(2x-1)(2x+1)}} = \frac{(2x-1)(2x+1)}{8x^2 + 2}$$

$$\frac{(4x^2 - 1)}{2(4x^2 + 1)}$$

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56) If $9x^4 + 12x^3 + 28x^2 + ax + b$ is a perfect square, find the values of a and b .

Answer :

$$\begin{array}{r}
 3x^2 + 2x + 4 \\
 \hline
 3x^2 \overline{) 9x^4 + 12x^3 + 28x^2 + ax + b} \quad (-) \\
 \underline{9x^4} \\
 12x^3 + 28x^2 \\
 \hline
 6x^2 + 2x \overline{) 12x^3 + 28x^2} \quad (-) \\
 \underline{12x^3 + 4x^2} \\
 24x^2 + ax + b \\
 \hline
 6x^2 + 4x + 4 \overline{) 24x^2 + ax + b} \quad (-) \\
 \underline{24x^2 + 16x + 16} \\
 0
 \end{array}$$

Because the given polynomial is a perfect square $a - 16 = 0$, $b - 16 = 0$
 Therefore, $a = 16$, $b = 16$.

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60) Find the values of m and n if the following expressions are perfect squares

$$\frac{1}{x^4} - \frac{6}{x^3} + \frac{13}{x^2} + \frac{m}{x} + n$$

Answer :

$$\begin{array}{r}
 \frac{1}{x^2} - \frac{3}{x} + 2 \\
 \hline
 \frac{1}{x^2} \quad \frac{1}{x^4} - \frac{6}{x^3} + \frac{13}{x^2} + \frac{m}{x} + n \\
 \quad (-) \quad \frac{1}{x^4} \\
 \hline
 \frac{2}{x^2} - \frac{3}{x} \quad \frac{6}{x^3} + \frac{13}{x^2} \\
 \quad (+) \quad (-) \quad \frac{6}{x^3} + \frac{9}{x^2} \\
 \hline
 \frac{2}{x^2} - \frac{6}{x} + 2 \quad \frac{4}{x^2} + \frac{m}{x} + n \\
 \quad (-) \quad (+) \quad (-) \quad \frac{4}{x^2} - \frac{12}{x} + n \\
 \hline
 0
 \end{array}$$

$$\therefore m = -12, n = 4$$

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- 68) A passenger train takes 1 hr more than an express train to travel a distance of 240 km from Chennai to Virudhachalam. The speed of passenger train is less than that of an express train by 20 km per hour. Find the average speed of both the trains.

Answer : Let the average speed of passenger train be x km/hr.

Then the average speed of express train will be $(x + 20)$ km/hr

Time taken by the passenger train to cover distance of 240 km = $\frac{240}{x}$ hr

Time taken by express train to cover distance of 240 km = $\frac{240}{x+20}$ hr

Given, $\frac{240}{x} = \frac{240}{x+20} + 1$

$240 \left| \frac{1}{x} - \frac{1}{x+20} \right| = 1$ gives, $240 \left| \frac{x+20-x}{x(x+20)} \right| = 1$ we get, $4800 = (x^2 + 20x)$

$x^2 + 20x - 4800 = 0$ gives, $(x + 80)(x - 60) = 0$ we get, $x = -80$ or 60 .

Therefore $x = 60$ (Rejecting -80 as speed cannot be negative)

Average speed of the passenger train is 60 km/hr

Average speed of the express train is 80 km/hr.

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79) Prove that the equation $x^2(p^2 + q^2) + 2x(pr + qs) + r^2 + s^2 = 0$ has no real roots. If $ps = qr$, then show that the roots are real and equal.

Answer : The given quadratic equation is, $x^2(p^2 + q^2) + 2x(pr + qs) + r^2 + s^2 = 0$

Here, $a = p^2 + q^2$, $b = (pr + qs)$, $c = r^2 + s^2$

Now, $\Delta = b^2 - 4ac = [2(pr + qs)]^2 - 4(p^2 + q^2)(r^2 + s^2)$

$= 4 [p^2r^2 + 2pqrs + q^2s^2 - p^2r^2 - p^2s^2 - q^2r^2 - q^2s^2]$

$= 4 [-p^2s^2 + 2pqrs - q^2r^2] = -4[(ps - qr)^2] < 0 \dots (1)$

Since, $\Delta = b^2 - 4ac < 0$, the roots are not real.

If $ps = qr$ then $\Delta = -4[ps - qr]^2 = -4[qr - qr]^2 = 0$ (using (1))

Thus, Δ is 0 if $ps = qr$ and so the roots will be real and equal.

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127) Find the values of m and n if the following expressions are perfect squares
 $x^4 - 8x^3 + mx^2 + nx + 16$

Answer :

$$\begin{array}{r}
 x^2 - 4x + 4 \\
 \hline
 x^2 \quad \begin{array}{l} \cancel{x^4} - 8x^3 + mx^2 + nx + 16 \\ (-) \quad \cancel{x^4} \end{array} \\
 \hline
 2x^2 - 4x \quad \begin{array}{l} \cancel{-8x^3} + mx^2 \\ (+) \quad \cancel{-8x^3} + 16x^2 \end{array} \\
 \hline
 2x^2 - 8x + 4 \quad \begin{array}{l} (m-16)x^2 + nx + 16 \\ (-) \quad \quad (+) \quad (-) \quad \cancel{16} \\ 8x^2 - 32x + \cancel{16} \end{array} \\
 \hline
 0
 \end{array}$$

$$\therefore m - 16 = 8$$

$$m = 8 + 16 = 24$$

$$n = -32$$

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142) Find the GCD of the given polynomials
 $3x^4 + 6x^3 - 12x^2 - 24x$, $4x^4 + 14x^3 + 8x^2 - 8x$

Answer : Let $f(x) = 4x^4 + 14x^3 + 8x^2 - 8x$

$$= 2(2x^4 + 7x^3 + 4x^2 - 4x)$$

$$g(x) = 3x^4 + 6x^3 - 12x^2 - 24x$$

$$= 3(x^4 + 2x^3 - 4x^2 - 8x)$$

Dividing $2x^4 + 7x^3 + 4x^2 - 4x$ by $x^4 + 2x^3 - 4x^2 - 8x$

$$\begin{array}{r} 2 \\ x^4 + 2x^3 - 4x^2 - 8x \overline{) 2x^4 + 7x^3 + 4x^2 - 4x} \\ \underline{2x^4 + 4x^3 - 8x^2 - 16x} \quad (-) \\ 3x^3 + 12x^2 + 12x \\ \underline{3x^3 + 4x^2 + 4x} \\ 8x^2 + 8x \end{array}$$

$= 3(x^3 + 4x^2 + 4x)$

Now, dividing $x^4 + 2x^3 - 4x^2 - 8x$ by $x^3 + 4x^2 + 4x$

$$\begin{array}{r} x - 2 \\ x^3 + 4x^2 + 4x \overline{) x^4 + 2x^3 - 4x^2 - 8x} \\ \underline{x^4 + 4x^3 + 4x^2} \quad (-) \\ -2x^3 - 8x^2 - 8x \\ \underline{-2x^3 - 8x^2 - 8x} \quad (-) \\ 0 \end{array}$$

Since, the remainder is zero, the GCD is $x^3 + 4x^2 + 4x$ i.e., $x(x^2 + 4x + 4)$

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- 148) A two digit number is such that the product of its digits is 12. When 36 is added to the number the digits interchange their places. Find the number.

Answer : Let the ten's digit of the number be x . It is given that the product of the digits is 12.

Unit's digit $\frac{12}{x}$

$$\text{Number} = 10x + \frac{12}{x}$$

It 36 is added to the number the digits interchange their places.

$$\therefore 10x + \frac{12}{x} + 36 = 10 \times \frac{12}{x} + x$$

$$\Rightarrow 10x + \frac{12}{x} + 36 = \frac{120}{x} + x$$

$$\Rightarrow 9x - \frac{108}{x} + 36 = 0$$

$$\Rightarrow 9x^2 - 108 + 36x = 0$$

$$\Rightarrow x^2 + 4x - 12 = 0$$

$$\Rightarrow (x + 6)(x - 2) = 0 \quad (\because (x + 6) \neq 0 \text{ as } x > 0)$$

$$x = -6, 2$$

But a number can never be (-ve). So, $x = 2$. The number is $10 \times 2 + \frac{12}{2} = 26$

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163) The sum of two natural numbers is 8. Determine the numbers if the sum of their reciprocals is $\frac{8}{15}$

Answer : Let the first number be ' x '

$\therefore$ Other number is $8 - x$ [$\because$ Sum is 8]

$$\text{Given, } \frac{1}{x} + \frac{1}{8-x} = \frac{8}{15}$$

$$\frac{8-x+x}{x(8-x)} = \frac{8}{15}$$

$$\frac{8}{x(8-x)} = \frac{8}{15}$$

$$x^2 - 8x + 15 = 0$$

$$(x - 5)(x - 3) = 0$$

$$x = 3, 5$$

$\therefore$ The two natural numbers are 3, 5

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