ENGINEERING MATHS

* ALGEBRA SKILLS
* TRANSPOSING EQUATIONS
* POLYNOMIAL DIVISION
* PARTIAL FRACTIONS

$$\frac{6}{x+3} = \frac{12}{7-4x}$$

$$\Rightarrow 6(7-4x) = 12(x+3)$$

$$\Rightarrow 42 - 24x = 12x + 36$$

$$\Rightarrow -24x - 12x = 36 - 42$$

$$\Rightarrow -36x = -6$$

$$\Rightarrow x = \frac{-6}{-36} = \frac{6}{36} = \underline{\underline{\frac{1}{6}}}$$

NOW YOU TRY:

SOLVE FOR x THIS EXPRESSION.

$$\frac{-8}{(x-2)} = \frac{6}{(3+2x)}$$

$$\frac{-8}{(x-2)} = \frac{6}{(3+2x)}$$

$$\Rightarrow -8(3+2x) = 6(x-2)$$

$$\Rightarrow -24-16x = 6x-12$$

$$\Rightarrow -16x-6x = -12+24$$

$$\Rightarrow -22x = 12$$

$$\Rightarrow \boxed{x = \frac{-12}{22} = \frac{-6}{11}}$$

TRANSPOSING EQUATIONS

TWO RESISTORS IN PARALLEL (R_1 AND R_2) HAVE A TOTAL $R_P = 72\Omega$

IF $R_1 = 180\Omega$ FIND R_2

ANSWER

$R_p = 72\Omega$

$R_1 = 180\Omega$

FIND R_2

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{72} = \frac{1}{180} + \frac{1}{R_2}$$

$$\therefore \frac{1}{R_2} = \frac{1}{72} - \frac{1}{180}$$

$$= \frac{180-72}{72 \times 180}$$

$$\therefore R_2 = \frac{72 \times 180}{180-72} = \boxed{120\Omega}$$

NOW YOU TRY ONE:

FOCAL LENGTH (f) FOR A LENS IS GIVEN BY:

$$\boxed{\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}}$$

IF $f = 20cm$; $d_o = 30cm$

FIND d_i

ANSWER

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$\therefore \frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$$

$$= \frac{d_o - f}{f \times d_o}$$

$$\therefore d_i = \frac{f d_o}{d_o - f}$$

$$= \frac{20cm \times 30cm}{30cm - 20cm} = \frac{600}{10} = \boxed{60cm}$$

AN LC PARALLEL CIRCUIT HAS THIS FORMULA FOR RESONANT FREQUENCY (f_R)

$$f_R = \frac{1}{2 \times \pi \times \sqrt{LC}}$$

GIVEN: $f_R = 2\,kHz$

$L = 4\,mH$

FIND C

① TRANSPOSE FORMULA.

$$f_R = \frac{1}{2\pi\sqrt{LC}}$$

$$\therefore \sqrt{LC} = \frac{1}{2 \times \pi \times f_R}$$

$$\Rightarrow LC = \frac{1}{2^2 \pi^2 f_R^2}$$

$$\therefore C = \frac{1}{4\pi^2 \cdot f_R^2 \cdot L}$$

$$= \frac{1}{4 \times \pi^2 \times (2\,kHz)^2 \times 4 \times 10^{-3}}$$

$$= 1.583 \times 10^{-6}$$

$$= \boxed{1.6\,\mu F}$$

NOW YOU TRY:

$$f_R = \frac{1}{2 \times \pi \times \sqrt{LC}}$$

GIVEN: $f_R = 3\,MHz$

$C = 120\,pF$

FIND VALUE OF L

ANSWER

$$f_R = \frac{1}{2\pi\sqrt{LC}}$$

TRANSPOSE

$$L = \frac{1}{4 \times \pi^2 \times (f_R)^2 \times C}$$

$$\Rightarrow L = \frac{1}{4 \times \pi^2 \times (3 \times 10^6)^2 \times 120 \times 10^{-12}}$$

$$= \frac{1}{4 \times \pi^2 \times 9 \times 10^{\cancel{12}} \times 120 \times 10^{\cancel{-12}}}$$

$$= \boxed{23.6\,\mu H}$$

LONG DIVISION

$$\begin{array}{r} 8405 \\ 45\,\overline{)\,378269} \\ 360 \\ \hline -\;182 \\ 180 \\ \hline -\;26 \\ 00 \\ \hline -\;269 \\ 225 \\ \hline 44 \end{array}$$

(REMAINDER)

SO $\dfrac{378269}{45} = 8405 + \dfrac{44}{45}$

SAME PRINCIPLE IS USED WITH POLYNOMIALS:

$$
\begin{array}{r l}
 & -4x^2 + 11x - 27 \\
x+2 & \overline{)\,-4x^3 + 3x^2 - 5x + 6} \\
- & -4x^3 - 8x^2 \\
\hline
 & \qquad 11x^2 - 5x \\
- & \qquad 11x^2 + 22x \\
\hline
 & \qquad\qquad -27x + 6 \\
- & \qquad\qquad -27x - 54 \\
\hline
 & \qquad\qquad\qquad +60
\end{array}
$$

+60 (REMAINDER)

ANSWER:

$$-4x^2 + 11x - 27 + \frac{60}{x+2}$$

ANOTHER EXAMPLE:

$$
\begin{array}{r l}
 & 6x^2 + 16x + 27 \\
x-2 & \overline{)\,6x^3 + 4x^2 - 5x - 54} \\
- & 6x^3 - 12x^2 \\
\hline
 & 16x^2 - 5x \\
- & 16x^2 - 32x \\
\hline
 & 27x - 54 \\
- & 27x - 54 \\
\hline
 & 0
\end{array}
$$

0 (NO REMAINDER !!)

ANSWER:

$$\boxed{6x^2 + 16x + 27}$$

NO REMAINDER!

YOU TRY ONE:

$$x - 3 \overline{\smash{)}\, 8x^3 + 6x^2 - 14x + 20}$$

YOU TRY ONE:

$$
\begin{array}{r l}
 & \quad 8x^2 + 30x + 76 \\
x - 3 & \overline{\big)\, 8x^3 + 6x^2 - 14x + 20} \\
 & \quad \underline{8x^3 - 24x^2} \\
- & \qquad\quad 30x^2 - 14x \\
 & \qquad\quad \underline{30x^2 - 90x} \\
- & \qquad\qquad\qquad 76x + 20 \\
 & \qquad\qquad\qquad \underline{76x - 228} \\
 & \qquad\qquad\qquad\quad 248 \ (\text{REM})
\end{array}
$$

ANSWER

$$8x^2 + 30x + 76 + \frac{248}{(x-3)}$$

PARTIAL FRACTIONS

WRITE IN PARTIAL FRACTIONS THIS EXPRESSION:

$$\frac{3x+2}{(x-4)(x+1)} = \frac{A}{(x-4)} + \frac{B}{(x+1)}$$

$$3x+2 = A(x+1) + B(x-4)$$

Let $x=-1$

$\Rightarrow -3+2 = A\times(0) + B(-5)$

$\Rightarrow -1 = -5B$

$\boxed{\Rightarrow B = \frac{1}{5}}$

LET $x=4$

$12+2 = 5A \Rightarrow 14 = 5A$

$\Rightarrow \boxed{A = \frac{14}{5}}$

SO $\boxed{\frac{3x+2}{(x-4)(x+1)} = \frac{14}{5(x-4)} + \frac{1}{5(x+1)}}$

NOW YOU DO ONE!
WRITE AS PARTIAL FRACTIONS:

$$\frac{5x-8}{(x-2)(x+3)}$$

NOW YOU DO ONE!

WRITE AS PARTIAL FRACTIONS:

$$\frac{5x-8}{(x-2)(x+3)} = \frac{A}{(x-2)} + \frac{B}{(x+3)}$$

$$\Rightarrow \quad 5x-8 = A(x+3) + B(x-2)$$

LET $x = -3$

$$-15-8 = -5B$$

$$-23 = -5B$$

$$\therefore B = \frac{23}{5}$$

LET $x = 2$

$$10-8 = 5A$$

$$\therefore 2 = 5A \quad \therefore A = \frac{2}{5}$$

SO

$$\boxed{\frac{5x-8}{(x-2)(x+3)} = \frac{2}{5(x-2)} + \frac{23}{5(x+3)}}$$