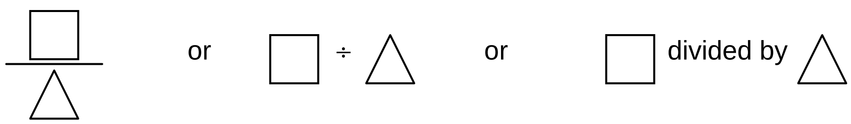
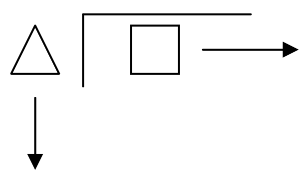
<u>Rules for Dividing Polynomials</u>

When dividing polynomials, the problem may be given to you in many ways like the following below:



Always begin rewriting the problem in ***long division*** *form:*



Always top term/first term

Always bottom term/second term

Example:

$$\left(x^5 + 2x^3 - 5x\right) \div \left(x^2 - 1\right)$$

1. *Rewrite the problem in long division form.*

$$x^2 - 1 \overset{?}{\overline{\big) x^5 + 2x^3 - 5x}}$$

2. *To figure out '**?**', divide the highest term under by the highest term outside division sign.*

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

3. *Just like regular long division, multiply result by every term outside the division sign.*

$$x^2 - 1 \overset{x^3}{\overline{\big) x^5 + 2x^3 - 5x}}$$
$$\underline{x^5 - x^3}$$

4. *Change the signs of the terms that were multiplied out.*

$$x^2 - 1 \overset{x^3}{\overline{\big) x^5 + 2x^3 - 5x}}$$
$$\underline{- x^5 + x^3}$$

5. *Combine like terms.*

$$x^2 - 1 \overset{x^3}{\overline{\big) x^5 + 2x^3 - 5x}}$$
$$\underline{- x^5 + x^3}$$
$$3x^3 - 5x$$

6. *Repeat the process again (Steps 2-5) with this as a new problem until division is done.*

(2)

$$\frac{3x^3}{x^2} = 3x$$

(3)

$$\begin{array}{r} x^3 + 3x \\ x^2 - 1 \overline{)\, x^5 + 2x^3 - 5x} \\ \underline{-x^5 + x^3} \\ 3x^3 - 5x \\ \underline{3x^3 - 3x} \end{array}$$

(4)

$$\begin{array}{r} x^3 + 3x \\ x^2 - 1 \overline{)\, x^5 + 2x^3 - 5x} \\ \underline{-x^5 + x^3} \\ 3x^3 - 5x \\ \underline{-3x^3 + 3x} \end{array}$$

(5)

$$\begin{array}{r} x^3 + 3x \\ x^2 - 1 \overline{)\, x^5 + 2x^3 - 5x} \\ \underline{-x^5 + x^3} \\ 3x^3 - 5x \\ \underline{-3x^3 + 3x} \\ -2x \end{array}$$

Since the highest power left behind is one and the highest power of the divisor is two, then -2x is a remainder because you can't divide x^2 to get another term. Hence

$$\left(x^5 + 2x^3 - 5x\right) \div \left(x^2 - 1\right) = \left(x^3 + 3x\right) R(-2x) = x^3 + 3x + \frac{-2x}{x^2 - 1}$$

denotes remainder