Polynomial Division

only works if ÷ by $x \pm \#$

Long Division

$\overline{2x+3}$

$$\frac{x^3 - 6x^2 - 27}{x - 2}$$

$$
\begin{array}{r|l}
 & x^2 - 4x - 8 \\
\hline
1x - 2 & x^3 - 6x^2 + 0x - 27 \\
\text{Change} \rightarrow & -x^3 + 2x^2 \\
\hline
 & -4x^2 + 0x \\
 & +4x^2 - 8x \\
\hline
 & -8x - 27 \\
 & +8x - 16 \\
\hline
 & -43
\end{array}
$$

$$\boxed{x^2 - 4x - 8 - \frac{43}{x-2}}$$

Synthetic Division

$$
\begin{array}{r|rrrr}
2 & 1 & -6 & 0 & -27 \\
+ & & 2 & -8 & -16 \\
\hline
 & 1 & -4 & -8 & -43
\end{array}
$$

$$\boxed{x^2 - 4x - 8 - \frac{43}{x-2}}$$

1) Drop 1st #
2) # below line * # in box → put in 2nd col.
3) Add down
4) Repeat.

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Function Operations

$f(x) = x^2 + 3x + 2 \qquad g(x) = 3x^2 - x + 7$

$$(f+g)(x) = x^2 + 3x + 2 + 3x^2 - x + 7$$

$$= 4x^2 + 2x + 9$$

$$=$$

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

$$= \cancel{3x^4} - \cancel{x^3} + \cancel{7x^2} + \cancel{9x^3} - \cancel{3x^2} + 21x + \cancel{6x^2} - 2x + 14$$

$$= 3x^4 + 8x^3 + 10x^2 + 19x + 14$$

$f(x) = 3x+2 \quad g(x) = x^2-2x+4 \quad h(x) = \frac{3x^2+2}{x^2-1} \quad K(x) = \sqrt{2x+1}$

Composition of functions = put a function in a function

$f[g(x)] = 3(x^2-2x+4)+2$

f of g of x $= 3x^2-6x+12+2$

$= \boxed{3x^2-6x+14}$

$(f \circ g)(x)$

$(h \circ K)(x)$

$= \frac{3(\sqrt{2x+1})^2+2}{(\sqrt{2x+1})^2-1}$

$= \frac{3(2x+1)+2}{2x+\cancel{1}-\cancel{1}}$

$= \frac{6x+3+2}{2x}$

$= \frac{6x+5}{2x}$

$f(x) = 3x+2 \quad g(x) = x^2-2x+4$

$(g \circ f)(3)$

$f(3) = 3(3)+2$

$= 11$

$g(11) = 11^2-2(11)+4$

$= 121-22+4$

Put 3 into f and find the value = 11.

Put that answer into g.

Easier to see it as $g[f(3)]$.