Synthetic Division

Steps:
1) Write coefficients down in descending order. (don't forget 0s for missing terms)
2) Write constant of divisor in box. Set $x-r=0$ to find value of r.
3) Bring down 1st coefficient.
4) Multiply 1st coeff. by r & write ans. under 2nd coeff.
5) Add those together
6) Repeat 4) & 5) until done.
7) Write the final poly w/ 1 less degree.

Ex ① $(2x^3-13x^2+26x-24)\div(x-4)$

$x-4=0$
$x=4$

$$\begin{array}{c|cccc} 4 & 2 & -13 & 26 & -24 \\ + & \downarrow & 8 & -20 & 24 \\ \hline & 2 & -5 & 6 & \boxed{0} \end{array}$$

remainder

Ans: $\boxed{2x^2-5x+6}$

② $(3x^2+7x-12)\div(x+3)$

$$\begin{array}{c|ccc} -3 & 3 & 7 & -12 \\ + & \downarrow & -9 & 6 \\ \hline & 3 & -2 & \boxed{-6} \end{array}$$

remainder

Ans: $\boxed{3x-2-\frac{6}{x+3}}$

③ $\dfrac{x^4-10x^2-2x+4}{x+3}$

Remainder Theorem:

When a poly $P(x)$ is divided by $(x-a)$, the remainder is $P(a)$.

④ Find remainder when $2x^4-15x^3-10x+302$ is divided by $x+4$.

$P(-4)=2(-4)^4-15(-4)^3-10(-4)+302$

$\boxed{P(-4)=1814}$

Factor Theorem:

For a poly $P(x)$, $(x-a)$ is a factor if and only if $P(a)=0$.

⑤ Is $(x-4)$ a factor of $2x^3-13x^2+26x-24$?

$x-4=0$
$x=4$

$P(4)=2(4)^3-13(4)^2+26(4)-24$
$=0$

$\boxed{\text{yes, it's a factor}}$