# PART 1: Dividing Rational Expressions

① $\frac{5x^2y^3}{x^7} \div \frac{30xy^4}{y^3} \Rightarrow \frac{5x^2y^3}{x^7} \cdot \frac{y^3}{30xy^4} = \frac{5x^2y^6}{30x^8y^4} = \boxed{\frac{1y^2}{6x^6}}$

② $\frac{x^2-6x-27}{2x^2+2x} \div \frac{x^2-14x+45}{x^2} \Rightarrow \frac{x^2-6x-27}{2x^2+2x} \cdot \frac{x^2}{x^2-14x+45}$

$= \frac{(x-9)(x+3)}{2x(x+1)} \cdot \frac{x^2}{(x-9)(x-5)}$

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

$= \frac{x(x+3)}{2(x+1)(x-5)}$

$= \boxed{\frac{x^2+3x}{2x^2-8x-10}}$

$2(x+1)(x-5)$
$2(x^2-5x+x-5)$
$2(x^2-4x-5)$
$2x^2-8x-10$

③ $\frac{x^2-8x+15}{x^2+4x} \div (x^2-x-20)$

$\frac{(x-5)(x-3)}{x(x+4)} \cdot \frac{1}{(x-5)(x+4)} = \frac{(x-3)}{x(x+4)(x+4)}$

$= \frac{x-3}{x(x^2+8x+16)} = \boxed{\frac{x-3}{x^3+8x^2+16x}}$

# PART 2: Long Division

Review! 523

$43\frac{7}{12}$

$43$

dividend

Review! $\frac{523}{12}$

$$\begin{array}{r} 43 \\ 12\overline{)523} \\ -48\downarrow \\ \hline 43 \\ -36 \\ \hline 7 \end{array}$$

divisor → 12 | 523 ← dividend

7 ← remainder

① $\frac{x^3-1}{x+1}$

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

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

② $\frac{x^4-3x^3+6x^2-3x+5}{x^2+1}$

$$\begin{array}{r} x^2-3x+5 \\ x^2+0x+1\overline{)x^4-3x^3+6x^2-3x+5} \\ -(x^4+0x^3+x^2)\downarrow \\ \hline -3x^3+5x^2-3x \\ -(-3x^3+0x^2-3x)\downarrow \\ \hline 5x^2+0x+5 \\ -(5x^2+0x+5) \end{array}$$

Check:
$(x^2-3x+5)(x^2+1)$

$$x^2-3x+5$$

PART 3: Synthetic Division

## PART 3: Synthetic Division

CAN ONLY BE DONE WHEN DIVIDING BY A LINEAR POLYNOMIAL!

$x^3 - 4x^2 + 0x + 1$

① $\dfrac{x^3 - 4x^2 + 1}{x - 2}$

$x - 2 = 0$

$+2 \quad +2$

$x = 2$

| | | | | |
|---|---|---|---|---|
| 2 | 1 | −4 | 0 | 1 |
| + ↓ | | 2 | −4 | −8 |
| | 1 | −2 | −4 | −7 |

$x^2 - 2x - 4 - \dfrac{7}{x-2}$

② $\dfrac{x^3 - 1}{x + 1}$ $\quad x^3 + 0x^2 + 0x - 1$

$x + 1 = 0$

$x = -1$

| | | | | |
|---|---|---|---|---|
| −1 | 1 | 0 | 0 | −1 |
| + ↓ | | −1 | 1 | −1 |
| | 1 | −1 | 1 | −2 |

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

③ $\dfrac{2x^2 - 3x + 1}{x - 2}$

$x - 2 = 0$

$x = 2$

| | | | |
|---|---|---|---|
| 2 | 2 | −3 | 1 |
| + ↓ | | 4 | 2 |
| | 2 | 1 | 3 |

$2x + 1 + \dfrac{3}{x-2}$