Synthetic Division

① Divide $3x^3 - 2x^2 + 3x - 4$ by $x-3$ using synthetic division.

$x-3=0$
$x=3$

3	3	-2	3	-4
		9	21	72
	3	7	24	68

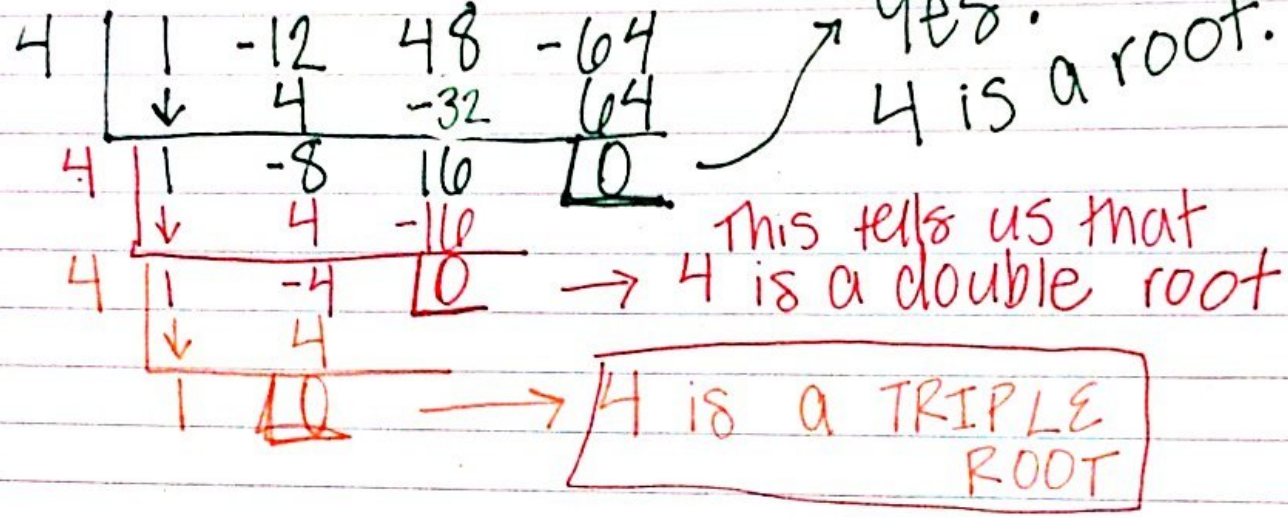
$$3x^2 + 7x + 24 + \frac{68}{x-3}$$

② Use synthetic division to determine whether $x-4$ is a factor of $-2x^5 + 6x^4 + 10x^3 - 6x^2 - 9x + 4$

4	-2	6	10	-6	-9	4
		-8	-8	8	8	-4
	-2	-2	2	2	-1	0

Yes, $x-4$ is a factor of $-2x^5 + 6x^4 + 10x^3 - 6x^2 - 9x + 4$ because the remainder is zero.

(3) Test to see if 4 is a root of $x^3 - 12x^2 + 48x - 64$.



Rational Root Theorem

★ RRT is a way to list possible rational roots. Divide the factors of the constant term by the factors of the leading coefficient to get possible roots. Test with synthetic division.

① Find the roots of $1x^3 - 2x^2 - x + 2$ → possible rational roots

Factors of 2: 2, 1
Factors of 1: 1
$= \pm 1, \pm 2$

↳ Don't forget ±

2	1	-2	-1	2
	↓	2	0	-2
	1	0	-1	0

→ 2 is a root

$x^2 - 1 = 0$

Quadratic Formula will give us our 2 other roots whether they're rational or not.

$x = \frac{0 \pm \sqrt{0^2 - 4(1)(-1)}}{2(1)}$

$x = \frac{\pm \sqrt{4}}{2}$

$x = \frac{\pm 2}{2}$

$x = \pm 1$

$\boxed{x = 2, -1, 1}$

② Find all roots : $3x^3 - 11x^2 + 5x + 3$

$$\frac{\text{Factors of } 3: \ 1, 3}{\text{Factors of } 3: \ 1, 3} = \pm\frac{1}{1}, \ \pm\frac{3}{1}, \ \pm\frac{1}{3}, \ \pm\frac{3}{3}$$

or $\pm 1, \pm 3, \pm \frac{1}{3}$

$\boxed{x = 3, 1, -\frac{1}{3}}$

Applications of Polynomials

① The difference between 2 integers is 7 and their product is 120. Find the integers.

$x - y = 7 \longrightarrow x = 7 + y$

$xy = 120 \qquad (7+y)(y) = 120$

$7y + y^2 = 120$

$y^2 + 7y - 120 = 0$

$y = \frac{-7 \pm \sqrt{7^2 - 4(1)(-120)}}{2(1)}$

$y = \frac{-7 \pm \sqrt{49 + 480}}{2}$

$y = \frac{-7 \pm \sqrt{529}}{2} \rightarrow y = \frac{-7 \pm 23}{2}$

$y = \frac{-7+23}{2} \qquad y = \frac{-7-23}{2}$

$y = 8 \qquad y = -15$

$x - 8 = 7$

$+8 \quad +8$

$x = 15$

$x - (-15) = 7$

$x + 15 = 7$

$x = -8$

$x = 15, y = 8$ $\qquad$ $x = -8, y = -15$

BOTH WORK