Sec. 5.4 Dividing Polynomials

Divide using long division

$(3x^3+9x^2+8x+4) \div (x+2)$

$3x^2+3x+2$

$-24+36-16+4$

$12-12$

0

$0 \quad f(-2)=0$

Ex: $(5x^2+2x+3) \div (x+1)$ $\frac{22}{7}=3\frac{1}{7}$

$5x-3+\frac{6}{x+1}$ Remainder / Divisor

$5x(x+1)$ $5x^2+2x+3$

$-5x^2+5x$

$-3x+3$

$+3x+3$

6 NOT a factor $\leftarrow$ $\rightarrow f(-1)=6$

$3\frac{1}{7}$

$7\overline{)22}$

-21

1

Ex: Is x^2-1 a factor of $3x^4-4x^3+12x^2+5$?

$3x^2-4x+15$

$x^2(x^2+0x-1)$ $3x^4-4x^3+12x^2+0x+5$

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

$-4x^3+15x^2+0x$

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

$15x^2-4x+5$

$-15x^2+0x+15$

$-4x+20$

$3x^2-4x+15+\frac{-4x+20}{x^2-1}$

Divide polynomial $P(x)$ of degree $n \geq 1$ by $x-a$, then the remainder is $P(a)$.

$(x^3-3x^2-5x-25)\div(x-5)$

$125-75-25-25$
0

x^2+2x+5
$x-5 \;\overline{)\; x^3-3x^2-5x-25}$
$-x^3+5x^2$ CHANGE SIGNS
$2x^2-5x$
$-2x^2+10x$
$5x-25$
$-5x+25$

$x-5$
x^2+2x+5 } factors of $x^3-3x^2-5x-25$ $\Leftarrow 0$ Remainder Theorem $f(5)=0$
$f(a)=R$

$x-a$

1 (1) 21 R1

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Synthetic Division (Substitution)

a. $(5x^2+2x+3) \div (x+1) = 0$ $\quad x=-1$

-1 | 5 (2) | 2 (1) | 3 (0) — Coefficients

mult ↑ | -5 | 3

$5x$ | -3 | 6 R. → $f(-1)=6$

$5x-3+\frac{6}{x+1}$

b. $(x^4+3x^3+7x^2+26x+15) \div (x+3)$

-3 | 1 (4) | 3 (3) | 7 (2) | 26 (1) | 15 (0) $\quad f(-3)=0$

| -3 | 0 | -21 | -15 $\quad x+3 \rightarrow$ factors

$1x^3$ | 0 | 7 | 5 | 0 $\quad x^3+7x+5 \rightarrow$ factors

x^3+7x+5

c. $(x^4-5x^2+4x+12) \div (x+2)$

$(x^4+0x^3-5x^2+4x+12)$

-2 | 1 (4) | 0 (3) | -5 (2) | 4 (1) | 12 (0)

| -2 | 4 | 2 | -12

1 | -2 | -1 | 6 | 0 $\quad f(-2)=0$

x^3-2x^2-x+6 } factors

$x+2$ }

d. $(x^4-\frac{9}{2}x^3+3x^2-\frac{1}{2}x) \div (x-\frac{1}{2})$

$\frac{1}{2}$ | 1 (4) | $-\frac{9}{2}$ (3) | 3 (2) | $-\frac{1}{2}$ (1) | 0 (0) $\quad f(\frac{1}{2})=0$

| $\frac{1}{2}$ | -2 | $\frac{1}{2}$ | 0

1 | -4 | 1 | 0 | 0

x^3-4x^2+x } factors

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

QE
- Factor ✗
- CTS ✓
- QF ✓

$(x-1)(x^3-4x^2+x)$

$(x-1)(x)(x^2-4x+1)=0$

$x=1 \quad x=0$

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

$x^2-4x+4=-1+4$

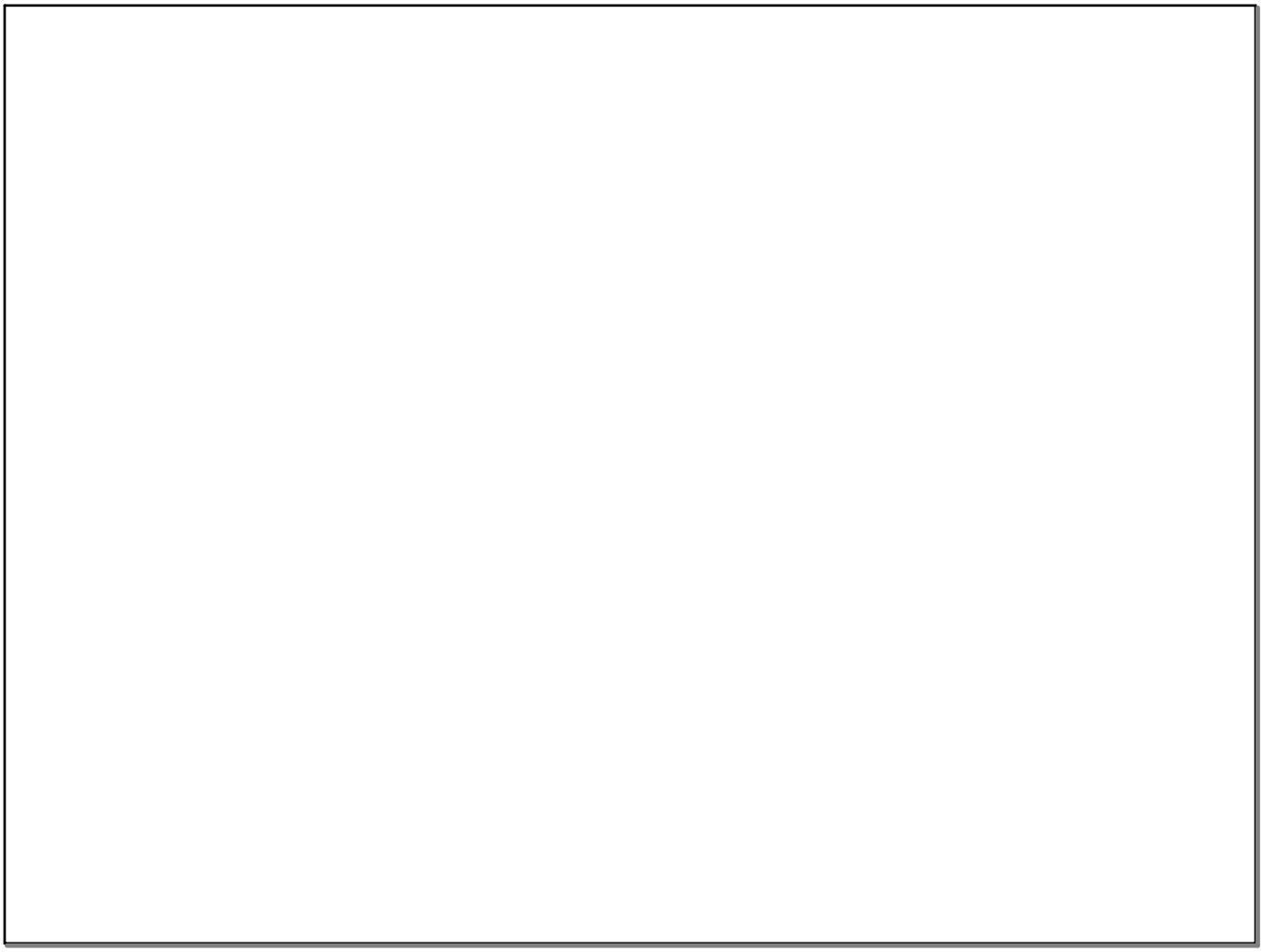
$(x-2)^2=3$

$x-2=\pm\sqrt{3}$

$+2 \quad +2$

$x=2\pm\sqrt{3}$

Apr 15-10:18 AM



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