

#36. $y = -2x^3 + x^2 - x + 7$

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

no neg. roots

$\pm 1, \pm 2, \pm 4$

#23. $x^4 - 2x^3 - 5x^2 + 8x + 4 = 0$

$$\begin{array}{r|rrrrr} 2 & 1 & -2 & -5 & 8 & 4 \\ & & 2 & 0 & -10 & -4 \\ \hline & 1 & 0 & -5 & -2 & \boxed{0 = f(2)} \end{array}$$

$(x-2)(x^3 - 5x - 2)$

$$\begin{array}{r|rrrr} \cancel{2} & 1 & 0 & -5 & -2 \\ & & 2 & 4 & -2 \\ \hline & 1 & 2 & -1 & \boxed{-4 = f(2)} \end{array}$$

$$\begin{array}{r|rrrr} -2 & 1 & 0 & -5 & -2 \\ & & -2 & 4 & 2 \\ \hline & 1 & -2 & -1 & \boxed{0 = f(-2)} \end{array}$$

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

$$\frac{\sqrt{4-2}}{2\sqrt{2}}$$

$$\downarrow \quad \downarrow$$
$$\boxed{x=2} \quad \boxed{x=-2}$$

$$x = \frac{2 \pm \sqrt{4+4}}{2(1)}$$

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

$$= \cancel{2} (1 \pm \sqrt{2})$$

$$\boxed{x = 1 \pm \sqrt{2}}$$

$$\#19. \quad x^3 - 10x - 12 = 0$$

$$\boxed{\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12}$$

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -10 & -12 \\ & & 2 & 4 & -12 \\ \hline & 1 & 2 & -6 & \boxed{-24 = f(2)} \end{array}$$

$$\begin{array}{r|rrrr} -2 & 1 & 0 & -10 & -12 \\ & & -2 & 4 & 12 \\ \hline & 1 & -2 & -6 & \boxed{0 = f(-2)} \end{array}$$

$$\frac{\sqrt{-28}}{2\sqrt{7}}$$

$$(x+2)(x^2-2x-6) = 0$$

$$\downarrow$$
$$\boxed{x = -2}$$

$$x = \frac{2 \pm \sqrt{4+24}}{2(1)} = \frac{2 \pm 2\sqrt{7}}{2} = \boxed{x = 1 \pm \sqrt{7}}$$

Roots : $1 \pm \sqrt{5}$ and $2 \pm i$

Polynomial : $x = 1 + \sqrt{5}$ $\left\{ \begin{array}{l} x = 2 + i \\ (x-2)^2 = (i)^2 \\ x^2 - 4x + 4 = -1 \\ x^2 - 4x + 5 = 0 \end{array} \right.$

$(x-1)(x-1)$ $(x-1)^2 = (\sqrt{5})^2$

$x^2 - 2x + 1 = 5$

$x^2 - 2x - 4 = 0$ $x^2 - 4x + 5 = 0$

$$f(x) = (x^2 - 2x - 4)(x^2 - 4x + 5)$$

$$= \underline{x^4} - \underline{4x^3} + \underline{5x^2} - \underline{2x^3} + \underline{8x^2} - 10x$$
$$\underline{-4x^2} + \underline{16x} - 20$$

$$f(x) = \boxed{x^4 - 6x^3 + 9x^2 + 6x - 20}$$

Ex. Roots: $x=4$, $x=-3$, $x=2 \pm 5\sqrt{2}$

\swarrow
 $x-4=0$

\swarrow
 $x+3=0$

\swarrow
 $(x-2)^2 = (5\sqrt{2})^2$

$(x-4)(x+3)$
 $= \underline{\underline{x^2 - x - 12}}$

$x^2 - 4x + 4 = 25 \cdot 2$
 $x^2 - 4x - 46 = 0$

$f(x) = (x^2 - x - 12)(x^2 - 4x - 46)$

$x^4 - 4x^3 - 46x^2$

$-x^3 + 4x^2 + 46x$

$-12x^2 + 48x + 552$

$f(x) = x^4 - 5x^3 - 54x^2 + 94x + 552$

$\begin{array}{r} 46 \\ 12 \\ \hline 92 \\ 46 \\ \hline 552 \end{array}$

Classwork

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Test Review (Test on Tuesday 9-12)

- ① $(-2 - 4i)(5 + 3i)$
- ② $(3 + 4i)^2$
- ③ simplify: $\frac{4 \pm \sqrt{-16}}{2}$
- ④ simplify: $\frac{5 \pm \sqrt{-125}}{5}$
- ⑤ Solve: $x^2 - 2x + 5 = 0$
- ⑥ Solve: $x^2 - 4x + 13 = 0$
- ⑦ Find the vertex: $y = x^2 - 4x + 5$
- ⑧ Find the vertex: $y = 2x^2 + 8x - 1$
- ⑨ Sketch: $y = (x - 2)^2 + 4$
- ⑩ Sketch: $y = 3 - (x - 1)^2$

$$\underline{\#21} \quad x = -5$$

$$\downarrow$$
$$\underline{x+5} = 0$$

$$x = 4 + 3i$$

$$\downarrow$$
$$(x-4)^2 = (3i)^2$$
$$x^2 - 8x + 16 = -9$$
$$\underline{x^2 - 8x + 25 = 0}$$

$$f(x) = (x+5)(x^2 - 8x + 25)$$

$$= x^3 - 8x^2 + 25x$$

$$+ 5x^2 - 40x + 125$$

$$= x^3 - 3x^2 - 15x + 125$$

$$f(2) = 2^3 - 3(2)^2 - 15(2) + 125$$

$$= 8 - 12 - 30 + 125$$

$$= 133 - 42$$

$$= 91 \checkmark$$

$$\#30 \quad x = -2, \quad x = -\frac{1}{2}, \quad x = i$$

$$\begin{array}{ccc} \downarrow & \downarrow & \downarrow \\ \underline{x+2} = 0 & 2x = -1 & x^2 = i^2 \\ & \underline{\underline{2x+1}} = 0 & x^2 = -1 \\ & & \underline{x^2+1} = 0 \end{array}$$

$$\overbrace{(x+2)(2x+1)} \quad (x^2+1) = 0$$

$$(2x^2+5x+2)(x^2+1) = 0$$

$$2x^4 + \underline{2x^2} + \underline{5x^3} + 5x + \underline{2x^2} + 2 = 0$$

$$\underline{2x^4 + 5x^3 + 4x^2 + 5x + 2} = 0$$

$$f(1) = 2 + 5 + 4 + 5 + 2 = 18 \checkmark$$