M-PC Pre-Calculus 3/14

Find the zeros:

$$(x-4)^{2}(x+3)^{4}(x^{2}-16)(x^{2}+9)$$

4 mult of 2, -3 mult of 4, ± 4, $\pm 3i$

2

# of possible zeros: 10

actual zeros: 6

times crossing x-axis: 4

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

$x-4=0$

$+4 \quad +4$

$x=4$

$x^2-16=0$

$+16 \quad +16$

$\sqrt{x^2}=\sqrt{16}$

$x=\pm 4$

$x^2+9=0$

$-9 \quad -9$

$\sqrt{x^2}=\sqrt{-9}$

$x=\pm 3i$

Find the lowest degreed polynomial with the zeros:

$-2, 3, 4i$

$\boxed{-4i}$

$i=\sqrt{-1}$

$x=-2$

$+2 \quad +2$

$x+2=0$

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

$(x-4i)(x+4i)$

$(x-4\sqrt{-1})(x+4\sqrt{-1})$

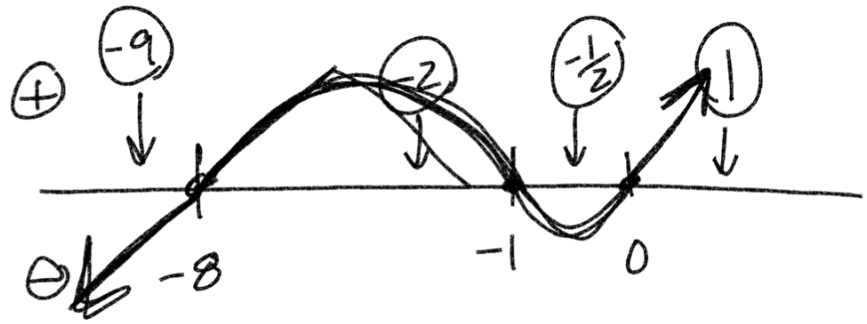
$x^2+\cancel{4x\sqrt{-1}}-\cancel{4x\sqrt{-1}}\underbrace{-16(-1)}_{+16}$

(x^2+16)

$x^3 + 9x^2 + 8x = 0$ Find the zeros and graph

$x(x^2 + 9x + 8) = 0$

$x(x+1)(x+8) = 0$



zeros: $0, -1, -8$

$$x(x+1)(x+8)$$

$$\begin{array}{lcccl} -9 & [- & - & - &] = - \\ -2 & [- & - & + &] = + \\ -\frac{1}{2} & [- & + & + &] = - \\ 1 & [+ & + & + &] = + \end{array}$$

$$x^3 + 9x^2 + 8x$$

$$\frac{x^3 + 9x^2 + 8x}{x+1} \qquad x+1 \neq 0$$

$$\frac{x\cancel{(x+1)}(x+8)}{\cancel{x+1}} = x(x+8)$$

zero: -1

$x = -1$

$+1 \quad +1$

$x + 1 = 0$

$x \neq -1$

$$
\begin{array}{r|l}
 & x^2 + 8x \\
\hline
x+1 & x^3 + 9x^2 + 8x \\
 & -x^3 - x^2 \\
\hline
 & 8x^2 + 8x \\
 & -8x^2 - 8x \\
\hline
 & 0
\end{array}
$$

$$\frac{x^3}{x} = \frac{x \cdot x \cdot \cancel{x}}{\cancel{x}} = x^2$$

$$\frac{8x^2}{x} = \frac{8x \cdot \cancel{x}}{\cancel{x}} = 8x$$

$$\boxed{x^2 + 8x}$$

Synthetic Division

$$
\begin{array}{r|rrr}
 & x^3 & + 9x^2 & + 8x \\
 & \downarrow & \downarrow & \downarrow \\
\hline
\boxed{x^2 + 8x} \quad -1 & 1 & 9 & 8 \\
 & & -1 & -8 \\
\hline
 & 1 & 8 & 0 \\
 & x^2 & x & \text{constant}
\end{array}
$$

$0x$

$x^2 - 9 \div x - 2$

$$
\begin{array}{r|l}
 & x + 2 \\
\hline
x - 2 & x^2 + 0x - 9 \\
 & -x^2 + 2x \\
\hline
 & 2x - 9 \\
 & -2x + 4 \\
\hline
 & -5
\end{array}
$$

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$x + 2 - 5/x-2$

	x^2	x	-5 const.
2	1	0	-9
		2	4
	1	2	-5

x constant Remainder

$x + 2 - 5/x-2$

$$
\begin{array}{r|l}
 & 4x^2 + 4x + 1 \\
\hline
3x+2 & 12x^3 + 20x^2 + 11x + 2 \\
 & -12x^3 \mp 8x^2 \quad \downarrow \\
\hline
 & 12x^2 + 11x \\
 & -12x^2 \mp 8x \\
\hline
 & 3x + 2 \\
 & -3x \mp 2 \\
\hline
 & 0
\end{array}
$$

$$\boxed{4x^2 + 4x + 1}$$

$$3x + 2 = 0$$
$$-2 \quad -2$$

$$\frac{3x}{3} = \frac{-2}{3}$$

$$x = -\frac{2}{3}$$

$$(2x^2 + 7x - 15) \div (x + 5)$$

$$
\begin{array}{r|l}
 & 2x - 3 \\
\hline
x+5 & 2x^2 + 7x - 15 \\
 & -2x^2 - 10x \quad \downarrow \\
\hline
 & -3x - 15 \\
 & +3x + 15 \\
\hline
 & 0
\end{array}
$$

$$\boxed{2x - 3}$$

$$
\begin{array}{r|rrr}
 & x^2 & x & \\
\hline
-5 & 2 & 7 & -15 \\
 & & -10 & 15 \\
\hline
 & 2 & -3 & 0
\end{array}
$$

$$\boxed{2x - 3}$$