

$$1) -1, 2, 3; f(-2) = 80$$

$$f(x) = a(x+1)(x-2)(x-3)$$

$$f(-2) = 80 = a(-2+1)(-2-2)(-2-3)$$

$$80 = a(-1)(-4)(-5)$$

$$80 = a \cdot 4(-5)$$

$$\frac{80}{-20} = a = -4$$

$$f(x) = -4(x+1)(x-2)(x-3)$$

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

$$f(x) = -4[x^3 - 4x^2 + x + 6]$$

$$f(x) = -4x^3 + 16x^2 - 4x - 24$$

$$3) -4, 3, 0; f(2) = -36$$

$$f(x) = a(x+4)(x-3)(x-0)$$

$$f(2) = -36 = a(2+4)(2-3)(2-0)$$

$$-36 = a(6)(-1)(2)$$

$$\frac{-36}{-12} = a = 3$$

$$f(x) = 3(x+4)(x-3)(x-0)$$

$$= 3x(x^2+x-12)$$

$$f(x) = 3x^3 + 3x^2 - 36x$$

$$\begin{array}{r} x-3 \\ x+4 \\ \hline x^2-3x \\ \hline x^2+x-12 \end{array}$$

Find zero & state multiplicity of each zero

15) $f(x) = x^2 (3x+2) (2x-5)^3$

$x^2 = 0$

$x = 0$

$3x+2=0$

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

$2x-5=0$

$x = \frac{5}{2}$

0 multiplicity 2; $-\frac{2}{3}$ multiplicity 1 & $\frac{5}{2}$ multiplicity 3

17) $f(x) = 4x^5 + 12x^4 + 9x^3$

$= x^3 (4x^2 + 12x + 9)$

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

$= \frac{b \pm \sqrt{b^2 - 4ac}}{2a}$

$\frac{12 \pm \sqrt{(12)^2 - 4(4)(9)}}{2(4)}$

$\frac{12 \pm \sqrt{144 - 144}}{8}$

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

0 multiplicity 3; $\frac{3}{2}$ multiplicity 2

Show the number is a zero of the given multiplicity.

23)

23) $f(x) = x^4 + 7x^3 + 13x^2 - 3x - 18$; -3 (multiplicity 2)

$$\begin{array}{r|rrrrr} -3 & 1 & 7 & 13 & -3 & -18 \\ & & -3 & -12 & -3 & 18 \\ \hline & 1 & 4 & 1 & -6 & 0 \end{array}$$

$[x - (-3)] [x^3 + 4x^2 + x - 6]$

$$\begin{array}{r|rrrr} -3 & 1 & 4 & 1 & -6 \\ & & -3 & -3 & 6 \\ \hline & 1 & 1 & -2 & 0 \end{array}$$

$[x - (-3)] [x - (-3)] [x^2 + x - 2]$

25) $f(x) = x^6 - 4x^5 + 5x^4 - 5x^2 + 4x - 1$; 1 (multiplicity 5)

$$\begin{array}{r|rrrrrrr} 1 & 1 & -4 & 5 & 0 & -5 & 4 & -1 \\ & & 1 & -3 & 2 & 2 & -3 & 1 \\ \hline \text{Zero 1 } \rightarrow & 1 & -3 & 2 & 2 & -3 & 1 & \textcircled{0} \end{array}$$

$$\begin{array}{r|rrrrrr} 1 & 1 & -3 & 2 & 2 & -3 & 1 \\ & & 1 & -2 & 0 & 2 & -1 \\ \hline \text{Zero 2 } \rightarrow & 1 & -2 & 0 & 2 & -1 & \textcircled{0} \end{array}$$

$$\begin{array}{r|rrrrrr} 1 & 1 & -2 & 0 & 2 & -1 \\ & & 1 & -1 & -1 & 1 \\ \hline \text{Zero 3 } \rightarrow & 1 & -1 & -1 & 1 & \textcircled{0} \end{array}$$

$$\begin{array}{r|rrrr} 1 & 1 & -1 & -1 & 1 \\ & & 1 & 0 & -1 \\ \hline \text{Zero 4 } \rightarrow & 1 & 0 & -1 & \textcircled{0} \end{array}$$

$$\begin{array}{r|rr} 1 & 1 & 0 & -1 \\ & & 1 & 1 \\ \hline \text{Zero 5 } \rightarrow & 1 & 1 & \textcircled{0} \end{array}$$

$$\boxed{f(x) = (x-1)(x-1)(x-1)(x-1)(x-1)(x+1)}$$