

1. Write a possible equation for the function containing the following zeros:

$$-2, 1 + 2i$$

$$\begin{aligned} f(x) &= (x+2)(x-1-2i)(x-1+2i) \\ &= (x+2)(x^2 - x + 2ix - x + 1 - 2i - 2ix + 2i - 4i^2) \\ &= (x+2)(x^2 - 2x + 1 + 4) \\ &= (x+2)(x^2 - 2x + 5) \\ &= x^3 - 2x^2 + 5x + 2x^2 - 4x + 10 \end{aligned}$$

$$f(x) = x^3 + x + 10$$



2. State the number of complex and real zeros for the following function:

$$f(x) = 7x^6 - 4x^5 + 4x - 2$$

complex zeros: 6 (b/c degree is 6)

real zeros: 2 (b/c there are 2 x-intercepts)



3. If $x=2$ is a zero of $f(x)$, find all remaining zeros for

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

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



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

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

$$x = \frac{2 \pm \sqrt{-4}}{2} = \frac{2 \pm 2i}{2} = \frac{2}{2} \pm \frac{2i}{2} = 1 \pm i$$

Zeros: $2, -1, 1 \pm i$

4. Find all zeros for $f(x)$

$$f(x) = x^3 + 3x^2 - 3x - 9$$

Zeros: $-3, -1.732, 1.732$



5. Describe all limits (end behavior and left and right of vertical asymptotes) for $f(x)$

$$f(x) = \frac{3x + 2}{2x - 4}$$

End Behavior

$$\lim_{x \rightarrow \infty} f(x) = \frac{3}{2} \text{ or } 1.5$$

$$\lim_{x \rightarrow -\infty} f(x) = \frac{3}{2}$$

V.A. @ $x = 2$

$$\lim_{x \rightarrow 2^-} f(x) = -\infty$$

$$\lim_{x \rightarrow 2^+} f(x) = \infty$$

6. Find all asymptotes for $f(x)$

$$f(x) = \frac{x-2}{3x-2}$$

V.A. \rightarrow denominator = 0

$$3x-2=0$$

$$3x=2$$

$$\boxed{\text{V.A. @ } x = \frac{2}{3}}$$

H.A. \rightarrow degree of Numer = 1 } =, so
degree of Denom = 1

H.A. @

$y =$ Leading
coefficients

$$\boxed{\text{H.A. @ } y = \frac{1}{3}}$$

7. Find all asymptotes for $f(x)$

$$f(x) = \frac{x+1}{x^2 - 5x - 6}$$

$$f(x) = \frac{x+1}{(x+1)(x-6)}$$

$$f(x) = \frac{1}{x-6}$$

V.A. @ $x=6$

H.A. → degree Numer = 1 } $N < D,$
degree Denom = 2 } so H.A.
@ $y=0$

H.A. @ $y=0$

8. Find all asymptotes for $f(x)$

$$f(x) = \frac{x^2}{x-1}$$

V.A. @ $x=1$

H.A. \rightarrow degree Numer = 2
degree Denom = 1 } $N > D,$
no H.A.

no H.A.

9. Solve for x:

$$\frac{x-3}{x} - \frac{3}{x+1} = \frac{3}{x^2+x}$$

$$\frac{x-3}{x} - \frac{3}{x+1} = \frac{3}{x(x+1)}$$

$$(x+1)(x-3) - 3x = 3$$

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

$$x^2 - 5x - 3 = 3$$

$$x^2 - 5x - 6 = 0$$

$$(x+1)(x-6) = 0$$

$$x = -1, \boxed{x = 6}$$

↖
extraneous
solution