Happy Get A Different Name Day!

- Park your phones
- Grab your calculators
- Start warm up (on circle table)

Slant Asymptote Warm-up:

$(x+3)(x+2) \Rightarrow \frac{(x+3)(x+2)}{(x+1)}$

Identify any asymptotes for $f(x) = \frac{x^2+5x+6}{x+1}$, then sketch a graph.

den=0

VA: $x=-1$ holes: none HA: none, maybe start

deg diff 1 yes

Slant Asym: $y=x+4$

$x+1 \overline{)\, x^2+5x+6}$

$-(x^2+x)$

$4x+6$

x-intercepts: $y=0$

$0 = \frac{(x+3)(x+2)}{(x+1)}$

$0 = (x+3)(x+2)$

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

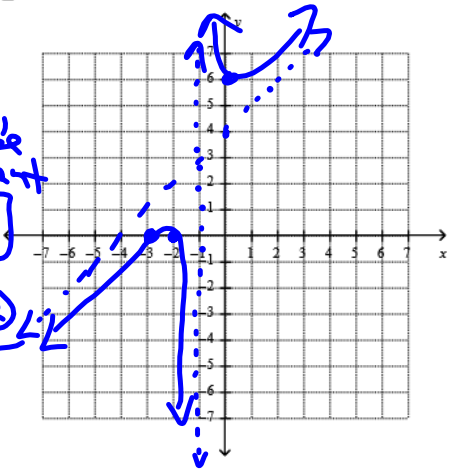
$(-3,0) \quad (-2,0)$

y-intercept: $x=0$

$y = \frac{(0+3)(0+2)}{(0+1)}$

$y = 6$

$(0,6)$



Identify any asymptotes for $f(x) = \frac{x^3-x+3}{x^2+x-2}$, then sketch a graph. (might need a calculator)

$(x+2)(x-1)$

VA: $x=-2$ $x=1$ holes: none HA: no

Slant Asym: $y=x-1$

$x^2+x-2 \overline{)\, x^3+0x^2-x+3}$

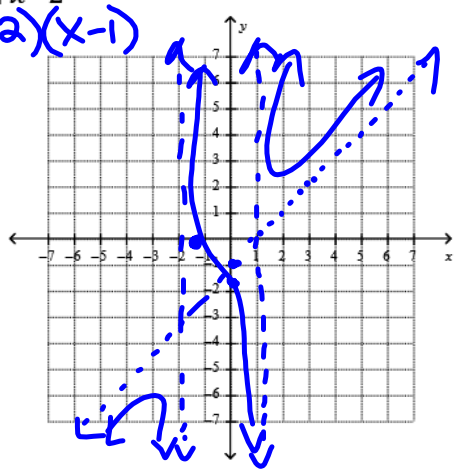
x-intercepts:

y-intercept:

$0 = x^3-x+3$

$x=-1.76$

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



$$3x^2 + 5x + 6 = Ax^2 + Bx + 3C$$

What's A? 3

B? 5

C? 2

Distinct Linear Factors

Decompose the following functions into partial fractions.

$\frac{x+7}{x^2-x-6} = \frac{A}{x-3} + \frac{B}{x+2} = \frac{A(x+2)}{(x-3)(x+2)} + \frac{B(x-3)}{(x-3)(x+2)}$

$(x-3)(x+2)$

Common den → $x+7 = A(x+2) + B(x-3)$

Denominators match, equate the numerators

number pick $x = ?$

$x=-2,\ (-2)+7 = A(-2+2) + B(-2-3)$

$5 = A(0) + B(-5)$

$5 = -5B$

$-1 = B$

number pick, again!

$x=3,\ (3)+7 = A(3+2) + B(3-3)$

$10 = A(5) + B(0)$

$10 = 5A$

$2 = A$

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

$\frac{-2x-39}{x^2+3x-18}$

$(x+6)(x-3)$

$\frac{-2x-39}{(x+6)(x-3)} = \frac{A}{x+6} + \frac{B}{x-3} = \frac{A(x-3)}{(x+6)(x-3)} + \frac{B(x+6)}{(x+6)(x-3)}$

$-2x-39 = A(x-3) + B(x+6)$

$x=3,\ -2(3)-39 = A(3-3) + B(3+6)$

$-45 = 9B$

$-5 = B$

$x=-6,\ -2(-6)-39 = A(-6-3) + B(-6+6)$

$-27 = -9A$

$3 = A$

$\frac{3}{x+6} + \frac{-5}{x-3}$ → either → $\frac{3}{x+6} - \frac{5}{x-3}$

Repeated Linear Factors

Decompose the following function into partial fractions.

$\frac{-7x-19}{x^2+8x+16} = \frac{A}{x+4} + \frac{B}{(x+4)^2} = \frac{A(x+4)}{(x+4)^2} + \frac{B}{(x+4)^2}$

$(x+4)(x+4)$

$(x+4)^2$

$-7x-19 = A(x+4) + B$

$x=-4,\ -7(-4)-19 = A(-4+4)+B$

$9 = B$

$B=9,\ -7x-19 = A(x+4)+9$

$-9 \quad -9$

$-7x-28 = A(x+4)$

$-7x-28 = Ax+4A$

$-7x = Ax \qquad -28 = 4A \qquad A=-7$

$\frac{-7}{x+4} + \frac{9}{(x+4)^2}$

Decompose the following function into partial fractions.

$\frac{7x^2+44x+53}{(x+2)(x^2+6x+9)} = \frac{A}{x+2} + \frac{B}{x+3} + \frac{C}{(x+3)^2} = \frac{A(x+3)^2}{(x+2)(x+3)^2} +$

$(x+3)(x+3)$

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

$\frac{B(x+2)(x+3)}{(x+2)(x+3)^2} + \frac{C(x+2)}{(x+2)(x+3)^2}$

$7x^2+44x+53 = A(x+3)^2 + B(x+2)(x+3) + C(x+2)$

$x=-2,\ 7(-2)^2+44(-2)+53 = A(-2+3)^2 + B(-2+2)(-2+3) + C(-2+2)$

$-7 = A$

$x=-3,\ 7(-3)^2+44(-3)+53 = A(-3+3)^2 + B(-3+2)(-3+3) + C(-3+2)$

$-16 = -1C$

$16 = C$

$7x^2+44x+53 = -7(x+3)^2 + B(x+2)(x+3) + 16(x+2)$

$7x^2+44x+53 = -7(x^2+6x+9) + B(x^2+5x+6) + 16x+32$

$7x^2+44x+53 = -7x^2-42x-63+Bx^2+5Bx+6B+16x+32$

$7x^2+44x+53 = -7x^2-26x-31+Bx^2+5Bx+6B$

$+7x^2+26x+31 \qquad +7x^2+26x+31$

$14x^2+70x+84 = Bx^2+5Bx+6B$

$B=14$

$\frac{-7}{x+2} + \frac{14}{x+3} + \frac{16}{(x+3)^2}$

Distinct Linear Factors

1)

$$\frac{5x+1}{(x+2)(x-1)}$$

2)

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

3)

$$\frac{x+2}{x^2+4x+3}$$

4)

$$\frac{2x^2+x-12}{x(x+3)(x+2)}$$

Repeated Linear Factors

5)

$$\frac{5x^2+20x+6}{x^3+2x^2+x}$$

6)

$$\frac{-3x+11}{x^2-4x+4}$$