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- Return Graded Work — Oct 18, 2018
- Announcements:
  ① Metacognition → if you have not yet completed this, next week will be your last chance
  ② Extra credit workshop Wed 10/24 4:30 - 5:30pm in 4-235. Topic will be graphing rational functions

- Finish §5.1 - Polynomial Functions and Models (p.64)
- All of §5.2 - Properties of Rational Functions (pp 65-68)
- Start §5.3 - The Graph of a Rational Function (pp 69-70)

* 12 days until the Chapter 4 and 5 Test

p 64 — §5.1

#5.131) Create a polynomial with...
Degree 3 — Leading Coefficient 1

Zeros (roots)	Multiplicity	Factor
8	1	$(x-8)$
3	2	$(x-3)$

$f(x) = 1(x-8)(x-3)(x-3)$
$f(x) = (x-8)(x-3)(x-3)$ → factored form

$f(x) = (x-8)(x-3)(x-3)$

$f(x) = (x^2-3x-8x+24)(x-3)$
$f(x) = (x^2-11x+24)(x-3)$

	x^2	$-11x$	$+24$
x	x^3	$-11x^2$	$24x$
-3	$-3x^2$	$+33x$	-72

$f(x) = x^3-14x^2+57x-72$

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p. 64 §5.1

#5.13) Create a polynomial with...
Degree 3 Leading Coefficient 1

Zeros(roots)	Multiplicity	Factor
8	1	$(x-8)$
3	2	$(x-3)$

$f(x) = 1(x-8)(x-3)(x-3)$
$f(x) = (x-8)(x-3)(x-3)$ → factored form

$f(x) = (x-8)(x-3)(x-3)$

$f(x) = (x^2-3x-8x+24)(x-3)$
$f(x) = (x^2-11x+24)(x-3)$

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$f(x) = x^3-14x^2+57x-72$

§5.2 Properties of Rational Functions

#29 Find the vertical asymptotes, if any, of:

$$R(x) = \frac{x^3 - 8}{x^2 - x - 2}$$ } factor numerator / } factor denominator

→ Numerator (Sidework)

$x^3 - 8$ → difference of cubes

$(x)^3 - (2)^3$ — "a" = x, "b" = 2

difference of cubes formula:

$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

$x^3 - 2^3 = (x-2)(x^2 + x\cdot 2 + 2^2)$

$x^3 - 8 = (x-2)(x^2 + 2x + 4)$

→ Denominator (Sidework)

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

$$R(x) = \frac{(x-2)(x^2+2x+4)}{(x-2)(x+1)}$$

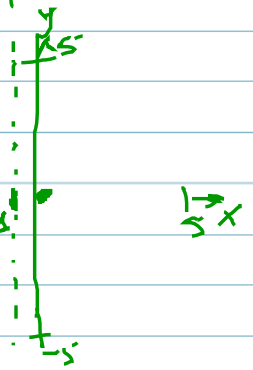
$$\text{Reduced } R(x) = \frac{x^2+2x+4}{x+1}$$

$x+1$ ← reduced denominator polyn.

set $x + 1 = 0$

$x = -1$

This solution is the equation of the vertical asymptote



Obs. sum of cubes formula:

$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

#5.1.20 and 5.1.21 → See graph

Equation of V.A

$x = 0$

- Domain: $(-\infty, 0) \cup (0, \infty)$ interval notation
- Range: $(-\infty, \infty)$ interval notation
- Intercepts (x-int $(-1, 0)$ and $(1, 0)$, no y-interc)

Find the horizontal or Oblique Asymptote

#5.2.28 $R(x) = \dfrac{3x}{1x+13}$ ← degree 1, ← degree 1 } Action (B) → horizontal asymptote $y = b$

b is $\frac{3}{1} = 3$ → $\boxed{y = 3}$

#5.2.29 $T(x) = \dfrac{x^3}{x^4 - 16}$ ← degree 3, ← degree 4 } Action (A)

$\text{Deg}_N < \text{Deg}_D$

$3 < 4$

So, horizontal asymptote $y = 0$

#5.2.30 $G(x) = \dfrac{x^4 - 256}{2x^2 - 8x}$ ← degree 4, ← degree 2 } Action (D)

$\text{Deg}_N - \text{Deg}_D \geq 2$

So, no horizontal or oblique asymptote

#5.2.33 $Q(x) = \dfrac{x^3 - 27}{x^2 + x - 12}$ ← degree 3, ← degree 2 } $\text{Deg}_N - \text{Deg}_D = 1$

Action (C)

Polynomial long division ⟹ $\dfrac{\text{NUMERATOR}}{\text{DENOMINATOR}}$ ⟹ DEN $\overline{)\text{NUM}}$

x^3	x^2	x	#
		x	-1
$x^2 + x - 12 \overline{)\, x^3}$	$+0x^2$	$+0x$	-27
$-x^3$	$-x^2$	$+12x$	
	$-1x^2$	$+12x$	-27
	$+1x^2$	$+x$	-12
		$113x$	-39 remainder

draw a line, change the sign and combine

Sw:

$\dfrac{x^3}{x^2} = x$ first piece of answer

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

$\dfrac{-1x^2}{x^2} = -1$ second piece of answer

$-1(x^2 + x - 12) = -x^2 - x + 12$

$x - 1 + \dfrac{13x - 39}{x^2 + x - 12}$

~~answer~~ for the long division

So, we have a remainder, which means that we have an oblique asymptote

Answer: $y = x - 1$ this is the oblique asymptote equation

So, we use the remainder just to know that there is an ~~weird~~ oblique asymptote, but we don't use it for our answer. The oblique asymptote equation will be only the result of the long division, but we don't consider the remainder

#5.2.21 Find the equation of the oblique asymptote:

- To find an equation of a line, we need a point and a slope

point: (0,0) → easier → y-interc.

slope: −2

$y = mx + b$ (slope intercept form)

$y = -2x + 0$

$y = -2x$ //

(0,0) (2,−4)

x_1, y_1 x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4-0}{2-0}$

$= \frac{-4}{2} \Rightarrow m = -2$