Today: 1.4 Simplifying Rational Expressions

Next class: Review DO NOW

(Wed) 2.1 Limits Graphically & Numerically
Round 2 Problem Set due

Two classes from now: Unit 1 "Test"
(Fri) Graded Problem Set due
1.4 DO NOW

1. Find an equation of the quadratic that has zeros at \( x = 4 \) and \( x = -1 \).
   \[
y = (x - 4)(x + 1)
   \]

2. Make adjustments to your equation from #1 so that the graph goes through the point (2, 18) but still has the same zeros.
   \[
   \begin{align*}
   y &= a(x - 4)(x + 1) \\
   18 &= a(-2)(3) \\
   18 &= a(-6)
   \end{align*}
   \]
   \( a = -3 \)
   \[
y = -3(x - 4)(x + 1)
   \]

3. Write a piecewise function that satisfies the following:
   a. For \( x \)-values less than 0, the \( y \)-value is 7 more than twice the \( x \)-value
   b. For \( x \)-values between 0 and 2, the \( y \)-value is the \( x \)-value squared
   c. For \( x \)-values bigger than 2, the \( y \)-value is 5
   \[
y = \begin{cases} 
   2x + 7 & \text{if } x < 0 \\
   x^2 & \text{if } 0 \leq x \leq 2 \\
   5 & \text{if } x > 2 
   \end{cases}
   \]

4. Graph the function you made in #3

5. Write an equation of the line that goes through the points (7, -3) and (9, 0). Use the point-slope form of a line to do this: \( y - y_1 = m(x - x_1) \).
   \[
   m = \frac{0 - (-3)}{9 - 7} = \frac{3}{2}
   \]
   \[
y - 0 = \frac{3}{2}(x - 9) \\
y + 3 = \frac{3}{2}(x - 7) \\
y = \frac{3}{2}x - \frac{27}{2}
   \]
\[(x+h)^2 = x^2 + 2xh + h^2 = (x+h)(x+h)\]

Notes: 1.4 Review (Simplifying Rational Expressions)

From last class...

Find \(\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}\) given \(f(x) = 2x^2 - 4x + 7\)

\[
\lim_{h \to 0} \frac{[2(x+h)^2 - 4(x+h) + 7] - [2x^2 - 4x + 7]}{h}
\]

\[
= \lim_{h \to 0} \frac{2x^2 + 4xh + 2h^2 - 4x - 4h + 7 - 2x^2 + 4x - 7}{h}
\]

\[
= \lim_{h \to 0} \frac{4xh + 2h^2 - 4h}{h}
\]

\[
= \lim_{h \to 0} \frac{h(4x + 2h - 4)}{h}
\]

\[
= 4x + 2h - 4
\]

What do you notice?

\[
\frac{x^2 - x - 30}{2x^2 + 3x - 35} = \frac{(x+5)(x-6)}{(2x-7)(x+5)}
\]

\[
= \frac{x-6}{2x-7}
\]

Method #1:

| \(\frac{6x^2 - 5x - 4}{3x^2 - 7x + 4}\) | \(\frac{x^2 - 2x - 8}{x^2 - 9x + 20}\) | \(\frac{x^2 - 6x + 5}{x^2 - 4}\) |
### What do you notice?

<table>
<thead>
<tr>
<th>Method #2: ( \text{conjugate} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{x-1}{\sqrt{5x-2} - \sqrt{x+2}} \cdot \frac{\sqrt{5x-2} + \sqrt{x+2}}{\sqrt{5x-2} + \sqrt{x+2}} )</td>
</tr>
<tr>
<td>( \frac{(x-1)(\sqrt{5x-2} + \sqrt{x+2})}{(5x-2) - (x+2)} )</td>
</tr>
<tr>
<td>( \frac{(x-1)(\sqrt{5x-2} + \sqrt{x+2})}{4x-4} )</td>
</tr>
<tr>
<td>( \frac{\sqrt{5x-2} + \sqrt{x+2}}{4} )</td>
</tr>
</tbody>
</table>

### What do you notice?

<table>
<thead>
<tr>
<th>Method #3:</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{x}{3 + x} \cdot \frac{3}{3x} = \frac{x-3}{3x(x-3)} = \frac{1}{3x} )</td>
</tr>
<tr>
<td>( \frac{1}{x^2} - \frac{1}{9} )</td>
</tr>
<tr>
<td>( \frac{1}{x-3} )</td>
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