

MATH 141: Quiz 1

Name: Key

— thought process
~~—~~ execution

Directions:

- * Show your thought process (commonly said as "show your work") when solving each problem for full credit.
- * If you do not know how to solve a problem, try your best and/or explain in English what you would do.
- * Good luck!

1. Rationalize the numerator:

$$\frac{\sqrt{x} - \sqrt{x+h}}{h} \quad \leftarrow \text{two term rationalization problem}$$

$$\begin{aligned} \frac{(\sqrt{x} - \sqrt{x+h})}{h} \cdot \frac{(\sqrt{x} + \sqrt{x+h})}{(\sqrt{x} + \sqrt{x+h})} &= \frac{(\sqrt{x})^2 - (\sqrt{x+h})^2}{h(\sqrt{x} + \sqrt{x+h})} \\ &= \frac{x - (x+h)}{h(\sqrt{x} + \sqrt{x+h})} \\ &= \frac{x - x - h}{h(\sqrt{x} + \sqrt{x+h})} \\ &= \frac{-h}{h(\sqrt{x} + \sqrt{x+h})} \\ &= \frac{1}{-\sqrt{x} - \sqrt{x+h}} \end{aligned}$$

special product

global factor h

multiplying by 2 terms.

2. Suppose $f(x) = x - x^2$. Evaluate and completely simplify the following:

$$* f(-1) = (-1) - (-1)^2 = -1 - 1 = \boxed{-2}$$

$$* f(x+h) - f(x)$$

$x+h$ is between the parentheses, therefore it is the input! " $x+h$ " must replace " x "

$$\begin{aligned} f(x+h) - f(x) &= (x+h) - (x+h)^2 - (x - x^2) \\ &= x+h - (x^2 + 2xh + h^2) - x + x^2 \\ &= x+h - x^2 - 2xh - h^2 - x + x^2 \\ &= h - 2xh - h^2 \\ &= \boxed{h(1 - 2x - h)} \end{aligned}$$

$f(x)$ is being subtracted, it has 2 terms.

subtracting 3 terms.

- we have compound fraction.
- Lecture Note IV says treat num/denom as separate problems.
3. Completely simplify (remember, write as one fraction only) the expression

denom missing factor $(x+1)$

$$\frac{\frac{1}{x-2} - 3}{x - \frac{2}{x+1}} \leftarrow \text{denom missing factor } (x-2)$$

$$\begin{aligned} \frac{\frac{1}{x-2} - 3 \cdot \frac{(x-2)}{(x-2)}}{\frac{(x+1)}{(x+1)} \cdot x - \frac{2}{(x+1)}} &= \frac{\frac{1}{x-2} - \frac{3(x-2)}{x-2}}{\frac{(x+1)x}{(x+1)} - \frac{2}{(x+1)}} \leftarrow \text{LCD attained. Let's subtract.} \\ &= \frac{\frac{1 - 3(x-2)}{(x-2)}}{\frac{x(x+1) - 2}{(x+1)}} \\ &= \frac{\frac{1 - 3x + 6}{(x-2)}}{\frac{x^2 + x - 2}{(x+1)}} \\ &= \frac{1 - 3x + 6}{(x-2)} \cdot \frac{(x+1)}{x^2 + x - 2} \\ &= \frac{-3x + 7}{(x-2)} \cdot \frac{(x+1)}{(x-2)(x-1)(x+2)} \end{aligned}$$

new X: $\begin{matrix} 1 & 2 \\ 1 & -1 \end{matrix}$ factor. $\rightarrow \frac{x^2 + x - 2}{(x+1)}$

from law 2

from law 1

$$= \frac{(-3x + 7)(x+1)}{(x-2)(x-1)(x+2)}$$

4. Completely factor the expression

$$\begin{aligned} &\text{factor out } -x^2 \\ &\underline{-x^4} - \underline{2x^3} - \underline{x^2} \quad \text{three terms} \\ &-x^4 - 2x^3 - x^2 = -x^2 (x^2 + 2x + 1) \\ &= \boxed{-x^2 (x+1)^2} \end{aligned}$$

5. Given a function $f(x)$, what is the tangent problem?

The act of finding a tangent line on a given point on the graph of a function.