EXAM 1 # TMath 124 Practice

Note: This is a practice exam and is intended only for study purposes. The actual exam will contain different questions and may have a different layout.

1. [] TRUE/FALSE: Let f and g be functions. Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F.

   T F $\frac{3x+y}{3z} = \frac{x+y}{z}$

   T F $(x+y)^2 = x^2 + y^2$

   T F $\lim_{x\to a} \dfrac{f(x)}{g(x)} = \dfrac{\lim_{x\to a} f(x)}{\lim_{x\to a} f(x)}$ for all a

   T F If $\lim_{x\to\infty} f(x) = \infty$ and $\lim_{x\to\infty} g(x) = \infty$, then $\lim_{x\to\infty}[f(x) - g(x)] = 0$.

   T F If f is continuous at a, then f is differentiable at a.

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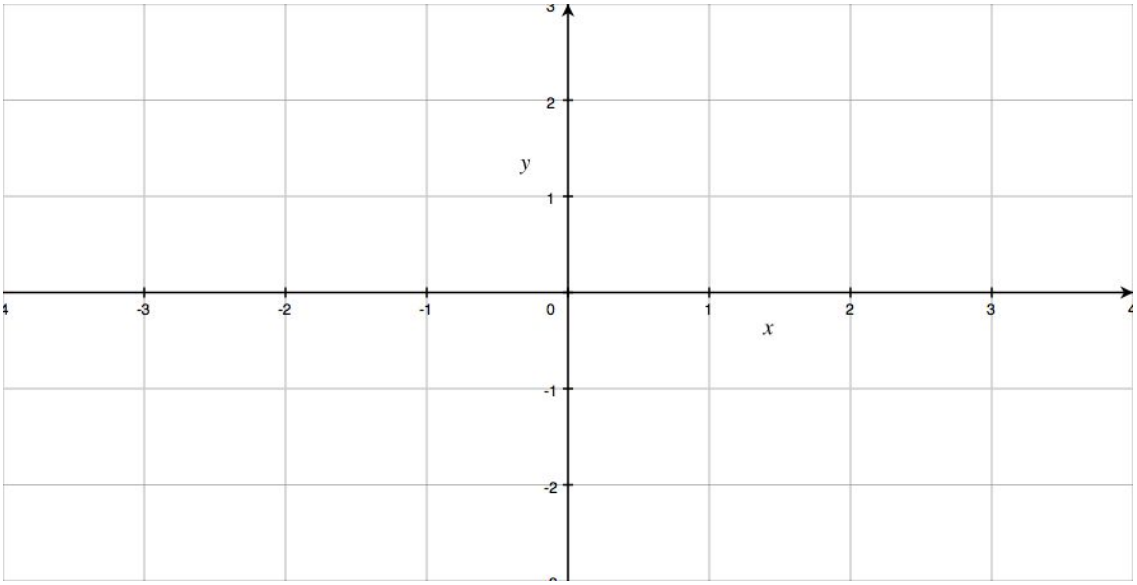
   Show your work for the following problems. The correct answer with no supporting work will receive NO credit (this includes multiple choice questions).

2. Find a formula for a function that satisfies all of the following criteria:

   - has a vertical asymptote at $x = 2$
   - a removable discontinuity at $x = 0$, and
   - horizontal asymptote at $y = -1$.

3. Given the rules of f and g below, graph both functions on the axis provided and evaluate the following

$$f(x) = \begin{cases} \frac{1}{x} & \text{if } x < 0, \\ 2 & \text{if } x = 0, \\ \ln x & \text{if } x > 0, \end{cases} \qquad g(x) = \sin(\tfrac{\pi}{4}x)$$



$\lim_{x\to\infty} g(x)$

$\lim_{x\to 0} f(x)$

f(0)

$\lim_{x\to 1}[\pi f(x) \times g(x)]$

$\lim_{x\to -2}(2f(x) + g(x))$

$g'(2)$

List any values that f is *not* continuous at:

Graph $g'(x)$

4. [] Find the limit if it exists, or explain why it does not exist.

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

$$\lim_{x\to\infty} e^{-2x}\sin x$$

$$\lim_{h\to 0} \frac{(1+h)^{-1}-1}{h}$$

$$\lim_{x\to\infty} \arctan(x^2-x^4)$$

$$\lim_{x\to 1} \frac{2x-2}{|x-1|}$$

$$\lim_{x\to 3^+} \ln(x-3)$$

5. Does $f(x) = 2x^3 + 6x^2 - 10x - 30$ have a root between 2 and 3? Explain your reasoning and cite theorems if you use any.

6. [] Find the equation for the line tangent to the graph of $y = \frac{1}{(x-2)^2}$, when $x = 3$.

7. Suppose that the motion of a ball can be described by the equation $f(t) = t^2 + t - 3$. Find the instantaneous velocity of the ball after 4 seconds.

8. [] Using the **definition**, find the derivative of $f(x) = \sqrt{2x - \frac{1}{2}}$

9. Describe 3 situations in which a function $f(x)$ could ***fail*** to be differentiable at a point.