TMath 124

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

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

   T F $\frac{d}{dx} b^c = cb^{c-1}$ for a fixed b and c

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

   T F $\frac{d}{dx} 2^x = x2^{x-1}$

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

2. Sketch the graph of an example function f that satisfies the following conditions:

   (a) f is not differentiable when $x = -3$
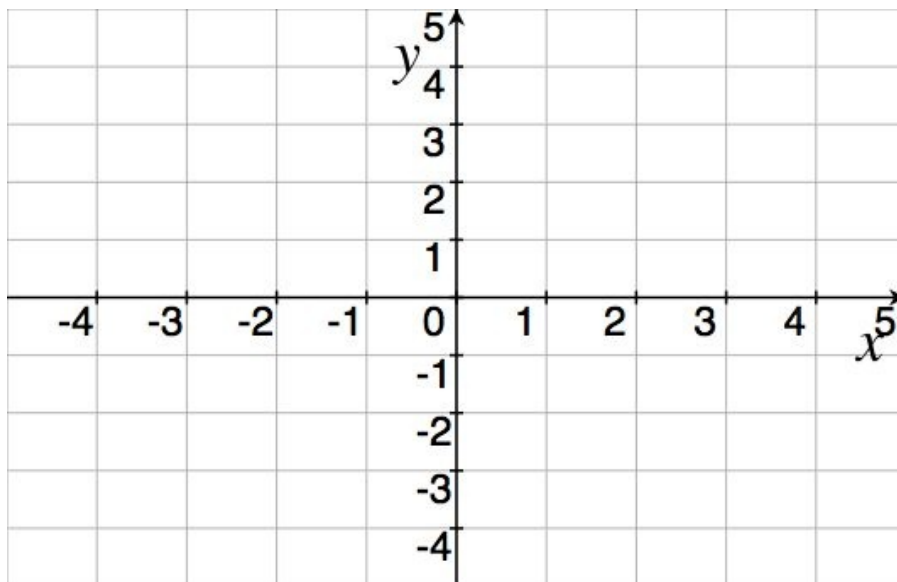
   (b) f is continuous when $x = -3$

   (c) $f(1) = -4$

   (d) $\lim_{x \to 1} f(x) = 2$

   (e) $f'(3) = -\dfrac{1}{2}$

   (f) $\lim_{x \to -1^+} f(x) = 0$

   (g) $\lim_{x \to -1^-} f(x) = 1$

3. Find a formula for the above graph you created.

4. Find the following:

$$\lim_{x \to 0} \frac{3\sin(4x)}{2\sin(3x)}$$

$$\lim_{x \to 0} \frac{\cos x - 1}{\sin x}$$

5. Suppose that $f(2) = -3$, $g(2) = 4$, $f'(2) = -2$, and $g'(2) = 7$. Find $h'(2)$ where h is:

$h(x) = 5f(x) - 4g(x)$

$h(x) = f(x)g(x)$

$h(x) = \frac{f(x)}{g(x)}$

$h(x) = \frac{g(x)}{1+f(x)}$

6. If $F(x) = f(g(x))$, where $f(-2) = 8$, $f'(-2) = 4$, $f'(5) = 3$, $g(5) = -2$, and $g'(5) = 6$, find $F'(5)$.

7. Find the $\frac{dy}{dx}$ of the following:

$$y = (2x^2 + 7x^2)(3^x - 2^x)$$

$$y = \frac{\sin(x) + x^2 \cos(x)}{\cos(x)}$$

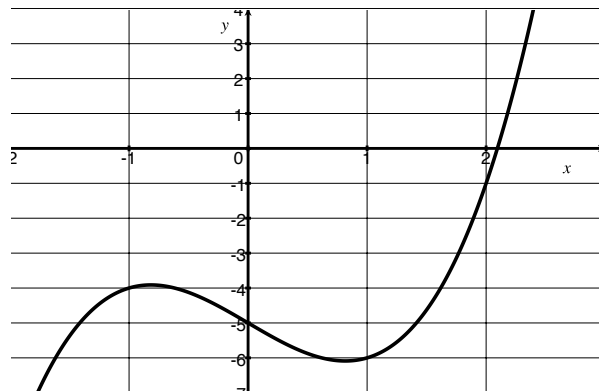$$y = \sqrt{\frac{x^2 + 1}{4x^5 - 3x}}$$

$$\frac{\sin^2(x^3)}{x}$$

$$y = \sin(e^{\sin(x^2)})$$

$$y = (\sin x)^{\ln e^2}$$

8. If $G(x) = f(xf(xf(x)))$, where $f(1) = 2$, $f(2) = 3$, $f'(1) = 4, f'(2) = 5$, and $f'(3) = 6$, find $G'(1)$.

9. Let $g(x) = x^3 - 2x - 5$. Notice the graph of g is provided below.

   (a) Find the linearization of $g(x)$ when $x = 2$.

   (b) Use linear approximation to estimate a root of $x^3 - 2x - 5$.

10. [5] Choose *ONE* of the following. Clearly identify which of the two you are answering and what work you want to be considered for credit.
No, doing both questions will not earn you extra credit.

(a) (§3.9 #21) [5] Ryan and Stella were being chased by a pack of zombies. At point P they decided to split up and Stella ran south at 12 ft/s. Ryan waited for ten seconds to try to draw most of the zombies towards him and then started to run east at 15 ft/s. One minute later the two of them are still alive and running in their respective directions. At what rate are Ryan and Stella moving apart at this instant?

(b) A man walks along a straight path at a speed of 4ft/s. A searchlight is located on the ground 20 ft from the path and is kept focused on the man. At what rate is the searchlight rotating when the man is 15ft from the point on the path closest to the searchlight?

11. [5] Choose *ONE* of the following. Clearly identify which of the two you are answering and what work you want to be considered for credit.
No, doing both questions will not earn you extra credit.

(a) (Story Problem Worksheet #10) If a current i passes through a resistor with resistance r, Ohm's Law states that the voltage drop is $v = ri$. Assume that voltage remains a constant 20 volts. An unreliable resistor claims a resistance of 10 ohms but may be off by up to 1.5 ohms. Use the linear approximation to approximate the error when calculating i.

(b) (§3.10) #35) The circumference of a sphere was measured to be 84cm with a possible error of 0.5cm. Use linear approximation to find and upper bound and lower bound for the surface areas of this sphere.