In 1-12 circle the best answer. Each problem is worth 4 points.

1. \( \lim_{x \to \infty} \frac{x^2 + 1000x + 5}{x^2 + 1} = \)
   a) \(\infty\) b) 5 c) 1 d) 1000 e) Limit does not exist

2. The function \( f(x) = \frac{2 - x}{5 - x} \) has a horizontal asymptote at
   a) \(y = 1\) b) \(y = 5\) c) \(y = 2\) d) \(y = 2/5\) e) no horizontal asymptotes

3. The function \( f(x) = \frac{2 - x}{5 - x} \) has a vertical asymptote at
   a) \(x = 1\) b) \(x = 5\) c) \(x = 2\) d) \(x = 2/5\) e) no vertical asymptotes

4. How many points on the graph of \( f(x) = x^3 - 2x \) have a horizontal tangent line?
   a) 0 b) 1 c) 2 d) 3 e) infinitely many

5. If \( f(x) = 2x^2 + x + 1 \) then \( f'(2) = \)
   a) 3 b) 2 c) 0 d) 9 e) none of the previous

6. If \( y = e^{2x} \) then
   a) \(\frac{dy}{dx} = e^{2x}\) b) \(\frac{dy}{dx} = x^2e^{2x-1}\) c) \(\frac{dy}{dx} = ye^{-2x}\) d) \(\frac{dy}{dx} = 2xe^{2x}\) e) \(\frac{dy}{dx} = 2xe^{2x}\)

7. If \( f(x) = x^3 \) then \( f'(x) = \)
   a) 147 b) 0 c) \(7^3\ln 7\) d) \(3/7\) e) \(f'(x)\) does not exist

8. If \( V(r) = \frac{4}{3}\pi r^3 \) and \( \frac{dv}{dr} = 2 \) then when \( r = 1 \)
   a) not enough information given b) \(\frac{4}{3}\pi\) c) \(\frac{8}{3}\pi\) d) \(4\pi\) e) \(8\pi\)

9. If \( f(x) = (x^2 + 1)^{12} \) then \( f'(x) = \)
   a) \(24x(x^2 + 1)^{11}\) b) \(12(2x)^{11}\) c) \(12(x^2 + 1)^{11}\) d) \((x^2 + 1)^{12}\log_{12}(x)\) e) \((2x)^{12}\)

10. If \( f(x) = \frac{2-x}{2+x} \) then \( f'(x) = \)
    a) -1 b) \(-1\) c) \(-4\) d) \(-2x - 4\) e) \(-\frac{x}{2+x}^2\)

11. If \( f(x) = x \ln(x) \) then \( f'(x) = \)
    a) \(\frac{1}{x}\) b) \(x \ln(1) + \ln(x)\) c) \(1 + \frac{1}{x}\) d) \(1 + \ln(x)\) e) \(x \ln(1)\)

12. If \( f(x) = e^{2x} \) then \( f''(0) = \)
    a) 4 b) 0 c) 3e d) 1 e) \(\infty\)
13. (16pts) Use a difference quotient to find the derivative of the function \( f(x) = 8x - 2 \)

\[
\lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \to 0} \frac{8(x+h) - 2 - (8x - 2)}{h}
\]

\[
= \lim_{h \to 0} \frac{8h}{h} = \lim_{h \to 0} 8 = 8
\]

14. (16pts) Use implicit differentiation to find \( \frac{dy}{dx} \) at \((1,0)\), where \( e^{y^2} + ye^x = 1 \)

\[
2yy'e^{yx} + ye^x + ye^x = 0
\]

\[
y'(2ye^{yx} + e^x) = -ye^x
\]

\[
y' = \frac{-ye^x}{2ye^{yx} + e^x}
\]

\[
y'(1,0) = \frac{0}{e} = 0
\]

15. (10pts) Find an equation for the tangent line to the graph of \( f(x) = x^3 + 3x^2 + x^{-3} \) at \( x = 1 \).

\[
f'(x) = 3x^2 + 6x - 3x^{-4}
\]

\[
m = f'(1) = 6
\]

\[
y - y_0 = m(x - x_0)
\]

\[
x_0 = 1, \quad y_0 = f(1) = 5
\]

\[
y = 5 + 6(x - 1)
\]

16. Suppose the cost in dollars of manufacturing \( x \) picnic tables is given by

\[ C(x) = 1000 + 100x + 500 \ln(x + 1) \]

(a) (5pts) What is the marginal cost function?

\[ C'(x) = 100 + \frac{500}{x+1} \]

(b) (5pts) After 100 tables have been manufactured, approximately how much more will it cost to manufacture another 10? (Use the marginal cost function.)

\[ C'(100) \text{ is approx. the cost to produce 101st picnic table,} \]

so \( 10C'(100) \) is approx. the cost to produce the next 10 tables

\[
10C'(100) = 10(104.950) = 1049.50
\]