1. What is the derivative of $f(x) = \tan x$?

   a) $\cos x$ **b)** $\sec x \tan x$

   c) $\sec^2 x$ **d)** $\sin^2 x$

2. Find the critical point(s) of the function $f(x) = 6x - x^2$.

   a) $x = 0, 6$ **b)** $x = 3$

   c) $x = 0, 3$ **d)** $x = 0$

3. What is the derivative of $f(x) = \tan x$.

   a) $\cos x$ **b)** $\sec x \tan x$

   c) $\sec^2 x$ **d)** $\sin^2 x$

4. Given the function $f(x) = x^3 - 6x$ the number $x = 0$ is which of the following:

   a) A local maximum. **b)** A global minimum.

   c) A critical point **d)** An inflection point.

5. What is the derivative of $f(x) = e^x \sin x$?

   a) $e^x \cos x$ **b)** $e^x(\sin x + \cos x)$

   c) $e^x \sin x + \cos x$ **d)** $e^x \sin x$

6. Find the interval on which the function $f(x) = xe^x$ is increasing.

   a) $(-\infty, 0)$ **b)** $(-\infty, \infty)$

c) $(-1, \infty)$ **d)** $(-1, 1)$

7. Evaluate the following limit:

$$\lim_{x \longrightarrow \infty} \frac{3x^3 + 7}{4x^3 + 2x + 1}$$

a) $+\infty$ **b)** $-\infty$

c) 0 **d)** $\frac{3}{4}$

e) $\frac{4}{3}$

8. Suppose f is a twice differentiable function and c is a critical point for which $f''(c) = 25$. Then the 2nd Derivative Test says that c is which of the following:

a) A local and global maximum. **b)** A local and global minimum.

c) A local maximum. **d)** A local minimum.

9. Determine the critical point(s) of $f(x) = 3x^5 + 5x^3 - 30x$.

a) $x = 2, -2$ **b)** $x = 1, -1$

c) $x = 2, 1$ **d)** $x = 1, 2, -1, -2$

10. f is a function for which $f''(x) = \frac{2x(x^2-3)}{x^2+1}^2$. On what interval(s) is the function concave up?

a) $(0, \infty)$ **b)** $(-\infty, -1)$ and $(1, \infty)$

c) $(-\sqrt{3}, \sqrt{3})$ **d)** $(-\infty, \sqrt{3})$ and $(\sqrt{3}, \infty)$

11. Find the derivative of $f(x) = \frac{x}{x+1}$

a) 1 **b)** $\frac{1}{(x+1)^2}$

c) $\frac{1}{x+1}$ **d)** $\frac{-1}{x+1}$

12. Find the inflection point(s) of $f(x) = \frac{e^x}{e^x+1}$.

a) $x = 1$ **b)** $x = e$

c) $x = 0$ **d)** $x = 1, -1$

13. Find the asymptotes of $f(x) = \frac{2x+1}{x^2-2x}$.

a) $VA = 0, 2$, $HA = 0$ **b)** $VA = 0, 2$, $HA = 2$

c) $VA = 2$, $HA = 0, 2$ **d)** $VA = 0$, $HA = 0, 2$

e) $VA = 2$, $HA = 0$

14. A particle is shot upward from a cannon with an initial velocity of 128 ft/s. Find the maximum height that the particle reaches:

a) 512 ft **b)** 212 ft **c)** 144 ft **d)** 256 ft **e)** None of above

15. Determine where the function $f(x) = x^3 + x^2 - 5x + 3$ is decreasing.

a) $(-\infty, -2)$ **b)** $(-\frac{5}{3}, 1)$

c) $(1, \infty)$ **d)** $(-2, 1)$

e) none of the above

16. Determine where the function $h(x) = x + \frac{1}{x}$ has a local maximum.

a) $x = 1$ **b)** $x = -1$

c) $x = \frac{1}{2}$ **d)** $x = \frac{-1}{2}$ **e)** $x = 2$

17. Suppose that it is determined that $k''(x) = \frac{e^x(x^2-1)}{x(x^2+1)}$. Where is $k(x)$ concave up? (Pick the best answer)

a) $(-\infty, 0)$ **b** $(0, \infty)$

c) $(0, 1)$ **d)** $(-1, 1)$ **e)** $(-1, 0)$