FE Practice
Math 1117

Score:	Print Name (First Last):	Date:

1. Evaluate the following limits:

   a. $\lim_{x \to 0^+} x \ln(x) =$

   b. $\lim_{x \to 0^+} x^x =$

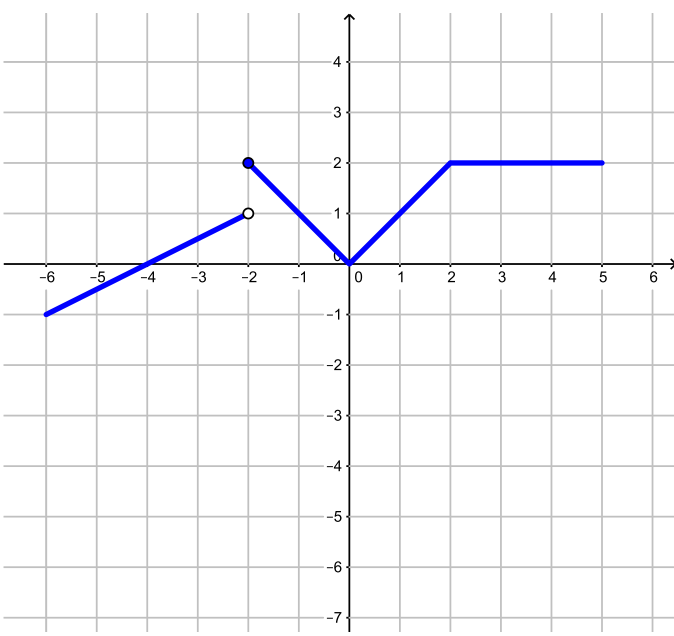
   c. $\lim_{x \to \infty} \frac{\ln(5x)}{5x} =$

   d. $\lim_{x \to 25} \frac{x - 25}{\sqrt{x} - 5} =$

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

   f. $\lim_{x \to \infty} \frac{x^2 + x - 1}{\sqrt{4x^4 + 5x + 1}} =$ (what is the HA?)

2. Given the graph of $f(x)$, locate the x-values:



   a. where $f' > 0$?

   b. where $f' < 0$?

   c. where $f' = 0$?

   d. where f' does not exist?

   e. where $f' = 1$?

   e. Where f is not continuous?

3. Using the limit definition of the derivative, find the derivative of: $f(x) = x^2 - 1$.

4. Find the following derivatives:

   a. $f(x) = e^x \cos(x^2)$, $f'(x) =$

   b. $f(x) = \dfrac{2^x}{x+1}$, $f'(x) =$

   c. $f(x) = \ln(\sin(x))$, $f'(x) =$

   d. $f(x) = \tan^{-1}(\sqrt{x})$, $f'(x) =$

   e. $y = x^{\sqrt{x}}$, $y' =$

   f. $\cos(xy) + y^3 = x$, $y' =$

   g. $\dfrac{d}{dx}\displaystyle\int_0^{x^2} \cos(t^2-1)\, dt =$

   h. $\dfrac{d}{dx}\displaystyle\int_{\sqrt{x}}^{1} (t^2-1)\, dt =$

5. Given that $f(x) = x^3 + x + 1$ is one-to-one, find the tangent line to the curve $y = f^{-1}(x)$ at $x = 3$.

6. Suppose the slope to the curve $y = f(x)$ at $(4,7)$ is $1/5$, find $(f^{-1})'(7)$.

7. Find the equation of the tangent <u>lines</u> to the equation $x^2 + y^2 = 1$ at $x = 1/2$.

8. a. Find the tangent line to the curve $f(x) = e^x$ at $x = 0$. Give a sketch of $f(x) = e^x$ and this tangent line.

   b. Approximate $e^{0.05}$.

   c. Approximate the change in outputs when x changes from 0 to 0.05.

9. The area of a circle is increasing at a rate of $1\,cm^2/s$. How fast is the radius changing when the diameter is $4\,cm$.

10. An icy cube is melting at a rate of $1\,in^3/s$. How fast is the side changing when the volume is $2\,in^3$.

11. A cylinder of height $10\,in$ is getting wider at a rate of $1\,in^3/s$. How fast is the radius changing when

the diameter is $2\,in$. The volume of a cylinder is $\pi r^2 h$.

12. Let the position function (in ft) of an object be $s(t) = t^2 - t + 1$ where time is in seconds (s).

    a. Find the average velocity on the time interval $[1, 2]$.

    b. Find the velocity and acceleration functions.

    c. Find the instantaneous velocity at $t = 1$.

13. Let $f(x) = x^{2/3}$ be defined on $[-1, 1]$.

    a. Find the absolute maximum/minimum **values** on the closed interval $[-1, 1]$.

    b. Can we apply the Mean Value Theorem to the above function on that interval? Explain.

14. Use the second derivative test to find the local max/min **values** of Let $f(x) = 2x^3 - 15x^2 + 24x$.

15. Let $f(x) = \dfrac{x^2}{x-2}$.

    a. Identify the domain and find the critical points of f.

    b. Find the intervals of increase/decrease of f.

    c. Find the local max/min **values**.

    d. Find the intervals where $f(x)$ is concave-up/down.

    e. Find the inflection point(s) $(p, f(p))$.

    f. Find vertical and slant asymptotes.

    g. Find the x-intercepts.

    h. Check the symmetry of $f(x)$ and graph it.

16. Let $f(x) = \frac{x^3}{3} - 9x$.

a. Identify the domain and find the critical points of f.

b. Find the intervals of increase/decrease of f.

c. Find the local max/min **values**.

d. Find the intervals where $f(x)$ is concave-up/down.

e. Find the inflection point(s) $(p, f(p))$.

f. Find the x-intercepts.

g. Check the symmetry of $f(x)$ and graph it.

17. Graph a function satisfying: $f'' > 0$ on $(-\infty, -2)$; $f''(-2) = 0$; $f'(-1) = f'(1) = 0$; $f''(2) = 0$; $f'(3) = 0$; $f''(x) > 0$ on $(4, \infty)$.

18. Find the linear approximation of $\sqrt{x}$ near $a = 1$ and use that to approximate $\sqrt{1.1}$. Approximate the change in outputs when x changed from 1 to 1.1.

19. A home owner is fencing her rectangular backyard using 200 ft of fencing material. One side of the yard is the house side and it does not need fencing. What are the dimensions that maximize the area of the yard?

20. Find two positive integers x and y such that $3x + y = 12$ and their product is as large as possible.

21. A square based box should be created with a sum of length, width and height not exceeding 64 in. What are the dimensions and volume of the square based box with the greatest volume under these conditions?

22. Find the definite integrals using geometry:

a. $\int_0^1 \sqrt{1-x^2}\, dx =$

b. $\int_{-2}^2 (x+1)\, dx =$

23. a. Please sketch the curve $y = \dfrac{1}{x}$ on $[1,5]$. Shade the area enclosed by the curve and the x-axis.

b. Approximate this area using four rectangles with right end points.

c. Approximate this area using four rectangles with left end points.

d. Approximate this area using four rectangles with mid points.

e. Find the exact value of the shaded area.

24. Find the exact area between the curve $f(x) = 2^x$ and the x-axis on the interval $[0,2]$.

25. Evaluate the following integrals:

a. $\displaystyle\int_0^{\pi} 2\cos(x)\,dx =$

b. $\displaystyle\int 2x - 3\sqrt{x} + 1\,dx =$

c. $\displaystyle\int_0^{1/2} \frac{3}{\sqrt{1-x^2}}\,dx =$

d. $\displaystyle\int \frac{x^2 - x - 1}{\sqrt{x}}\,dx =$

e. $\displaystyle\int (6x-3)(\sqrt{x}+5x)\,dx =$

f. $\displaystyle\int (6x-3)\cos(3x^2-3x)\,dx =$

g. $\displaystyle\int x^9 e^{x^{10}}\,dx =$

h. $\displaystyle\int_0^1 \frac{2x}{x^2+3}\,dx =$