1. Evaluate the following limit.

$$\lim_{h\to 0}\left(\frac{1}{h}-\frac{1}{h^2+h}\right)$$

A) $-\infty$ B) -2 C) -1 D) 0
E) 1 F) 2 G) ∞ H) Does not exist.

2. Let

$$f(x)=2x\ln x,\ \text{for } x>0.$$

$$\text{Find } f''(2).$$

A) -2 B) -1 C) $\frac{-1}{2}$ D) 0
E) $\ln 2$ F) 1 G) 2 H) $2\ln 2+2$

3. Find the local minimum value of

$$f(x)=x^3-5x^2-8x+50$$

A) -1 B) 0 C) 1 D) $\frac{5}{3}$
E) 2 F) $\frac{7}{3}$ G) 3 H) 4

4. Find the value of $\frac{dy}{dx}$ at the point $\left(-3^{3/2},1\right)$ on the curve

$$\sqrt[3]{x^2}+\sqrt[3]{y^2}=4.$$

A) $-\sqrt{3}$ E) 1
B) -1 F) $\sqrt{3}$
C) 0 G) 2
D) $\frac{1}{\sqrt{3}}$ H) 3

5. Find an equation of the line tangent to

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

At the point where $x = 0$.

A) $y = 2x + 1$ B) $y = \cos(x)e^{2x}$ C) $y = -(x+1)$ D) $y = 2x$

E) $y = x$ F) $y = 1$ G) $y = \sin(2x)e^{\cos(2x)}$ H) $y = \frac{1}{2}x + 3$

6. Find the equations of all horizontal and vertical asymptotes to the curve

$$f(x) = \frac{4x^2 - 1}{x^2 - 3x + 2}.$$

(Choose the answer that has all the correct lines)

A) $x = 1, x = 2, y = \frac{1}{2}$

B) $x = 1, y = \frac{1}{2}, y = 4$

C) $x = 2, y = 1$

D) $x = 0, x = -1, y = \frac{1}{2}$

E) $x = 4, x = 1$

F) $x = 1, x = 2, y = 4$

G) $x = -1, x = 2, y = \frac{1}{2}$

H) $x = \frac{1}{2}, x = 2, y = \frac{1}{2}$

7. Let

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

Find the number c satisfying the conclusion of the Mean Value Theorem on the interval $[1, 3]$.

A) 1 E) $\sqrt{3}$

B) $\frac{5}{4}$ F) 2

C) $\frac{3}{2}$ G) $\frac{5}{2}$

D) $\frac{8}{5}$ H) 3

8. A woman 5 ft. tall is walking at a speed of 6 $\frac{\text{ft.}}{\text{sec.}}$ away from a streetlight which is mounted at a height of 20 ft. How fast is the tip of her shadow moving when she is 10 ft. from the light?

A) 4 $\frac{\text{ft.}}{\text{sec.}}$ B) 5 $\frac{\text{ft.}}{\text{sec.}}$ C) 6 $\frac{\text{ft.}}{\text{sec.}}$ D) 7 $\frac{\text{ft.}}{\text{sec.}}$
E) 8 $\frac{\text{ft.}}{\text{sec.}}$ F) 9 $\frac{\text{ft.}}{\text{sec.}}$ G) 10 $\frac{\text{ft.}}{\text{sec.}}$ H) 12 $\frac{\text{ft.}}{\text{sec.}}$

9. For what x value(s) is the following function ***not*** differentiable?

$$f(x)=\begin{cases} 6\cos(x)+5e^{-x} & \text{if } x\le 0 \\ x^2-5x+11 & \text{if } 0<x<2 \\ \frac{x^2+1}{x-1} & \text{if } x\ge 2 \end{cases}$$

A) $\{0,1,2\}$ B) $\{0,1\}$ C) $\{0,2\}$ D) $\{1,2\}$
E) $\{0\}$ F) $\{1\}$ G) $\{2\}$
H) $f(x)$ is differentiable for all x

10. Jack wishes to construct a cylindrical barrel with a volume of 32π ft^3. The cost per square foot of the material for the side is \$ 3 and the cost per square foot for the material for the top and bottom is \$ 6. Find the height of the barrel that can be constructed at a minimum cost.

A) $h=2$ ft. B) $h=3$ ft. C) $h=4$ ft. D) $h=6$ ft.
E) $h=8$ ft. F) $h=10$ ft. G) $h=12$ ft. H) $h=16$ ft.

11. Let

$$G(x)=\int_1^{6x}\cos^2\left(\tfrac{1}{t}\right)dt.$$

Find

$$G'\left(\frac{1}{\pi}\right).$$

A) $\frac{-3}{2}$ E) $\frac{3}{4}$
B) $\frac{-1}{2}$ F) 2
C) 0 G) $\frac{5}{2}$
D) $\frac{1}{2}$ H) $\frac{9}{2}$

12. Evaluate the integral

$$\int_1^2 \left(\frac{x-1}{x^3} \right) dx$$

A) $\frac{-1}{2}$ E) $\frac{1}{2}$

B) 0 F) 1

C) $\frac{1}{8}$ G) $\frac{3}{2}$

D) $\frac{1}{4}$ H) 2

13. Evaluate the integral

$$\int_1^{\sqrt{e}} \frac{dx}{x\sqrt{1-(\ln x)^2}}$$

A) $\frac{-1}{6}$ E) $\frac{\pi}{6}$

B) 0 F) $\frac{\pi}{3}$

C) $\frac{1}{6}$ G) $\frac{3}{2}$

D) $\frac{1}{3}$ H) 2

14. Evaluate the following limit.

$$\lim_{t \to 1} \frac{(\ln t)^2}{4t^3 - 12t + 8}$$

A) $-\infty$ B) -1 C) 0 D) $\frac{1}{2}$

E) $\frac{1}{4}$ F) $\frac{1}{12}$ G) ∞ H) Does not exist.

Problem	ANSWER		Problem	ANSWER
1	E		8	E
2	F		9	H
3	E		10	E
4	D		11	H
5	A		12	C
6	F		13	E
7	E		14	F