1. Find a value for k so that the function

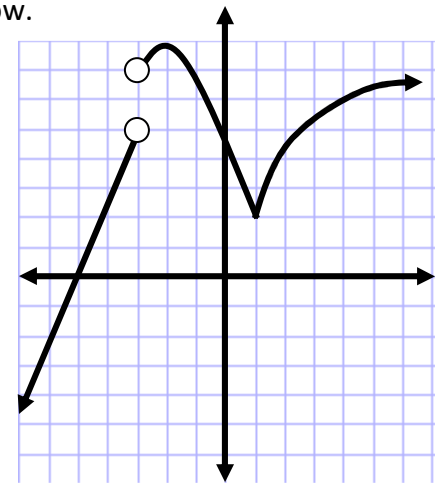
$$f(x)=\begin{cases} 3x-k & \text{if } x\le 1 \\ \dfrac{x^2-3x+2}{x-1} & \text{if } x>1 \end{cases}$$

will be continuous at $x=1$.

A) -3 B) -2 C) -1 D) 0

E) $\frac{1}{2}$ F) 2 G) 3 H) 4

2. Consider the figure below.



Which of the following 3 statements are true?

I. $f(x)$ is differentiable at $x=-3$.

II. $f(x)$ is continuous at $x=1$.

III. $(1,2)$ is a local minimum

For full credit you must add an explanation.

A) I only B) II only C) III only D) I and II

E) I and III F) II and III G) I, II, and III H) none are true

3. Let $f(x)=x^2\ln(2x)$.

Find $f'\left(\frac{e}{2}\right)$.

A) $\frac{e}{2}$ B) e C) $\frac{5e}{4}$ D) $\frac{3e}{2}$

E) $2e$ F) $\frac{5e}{2}$ G) $3e$ H) $\frac{7\pi}{4}$

4. Find the equation of the tangent line to the curve $y^2 \sin x + x^2 \cos y = 0$ at the point $\left(\pi, \frac{\pi}{2}\right)$.

A) $y = \frac{1}{4}x + \frac{\pi}{4}$ B) $y = \frac{1}{4}x + \frac{\pi}{2}$ C) $y = -\frac{1}{4}x + \frac{\pi}{4}$ D) $y = -\frac{1}{4}x + \frac{3\pi}{4}$

E) $y = \frac{1}{2}x$ F) $y = -\frac{1}{2}x + \pi$ G) $y = x - \frac{\pi}{2}$ H) $y = -x + \frac{3\pi}{2}$

5. A 10 ft. long ladder rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 2 $\frac{\text{ft.}}{\text{s.}}$, how fast is the top of the ladder sliding when it is 2 ft. above the ground?

A) $-4\sqrt{3}\,\frac{\text{ft.}}{\text{s.}}$ B) $-2\sqrt{3}\,\frac{\text{ft.}}{\text{s.}}$ C) $-4\sqrt{2}\,\frac{\text{ft.}}{\text{s.}}$ D) $-8\sqrt{6}\,\frac{\text{ft.}}{\text{s.}}$

E) $-4\sqrt{6}\,\frac{\text{ft.}}{\text{s.}}$ F) $-2\,\frac{\text{ft.}}{\text{s.}}$ G) $-4\,\frac{\text{ft.}}{\text{s.}}$ H) $-2\sqrt{2}\,\frac{\text{ft.}}{\text{s.}}$

6. Find the absolute minimum value of

$$f(x) = x - \frac{4x}{x+1}$$

on the interval $[0,3]$

A) 0 B) 1 C) -1 D) 2

E) -2 F) $\frac{1}{2}$ G) $-\frac{1}{2}$ H) 3

7. If $f(x) = \sin x + cx$ has a local extreme value at $x = 2$, then find the value of c and tell if f has a local maximum or local minimum at that point.

A) $c = \cos 2,\ \text{local min}$ E) $c = \sin 2,\ \text{local min}$

B) $c = \cos 2,\ \text{local max}$ F) $c = \sin 2,\ \text{local max}$

C) $c = -\cos 2,\ \text{local min}$ G) $c = -\sin 2,\ \text{local min}$

D) $c = -\cos 2,\ \text{local max}$ H) $c = -\sin 2,\ \text{local max}$

8. Let $f(x)=x^4-18x^2$. Find the interval where $f(x)$ is concave down and decreasing.

A) $(0,\sqrt{3})$ B) $(0,3)$ C) $(-3,0)$ D) $(-\sqrt{3},0)$

E) $(3,\infty)$ F) $(-\infty,0)$ G) $(0,2)$ H) $(-2,0)$

9. Find the value of the limit (if it exists)

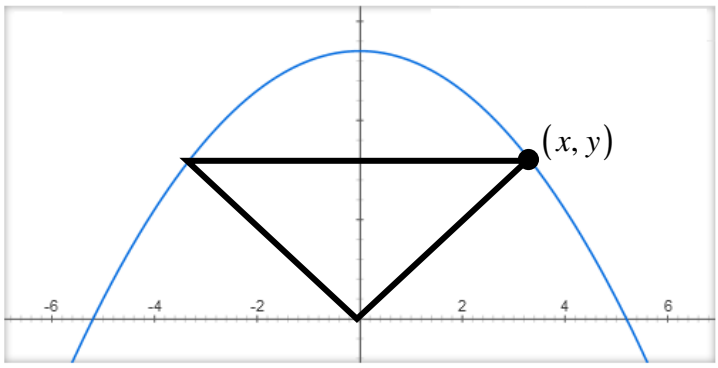
$\lim_{x\to 0}\dfrac{e^x+e^{-x}-2}{x^2}$.

A) 0 B) 1 C) -1 D) 2

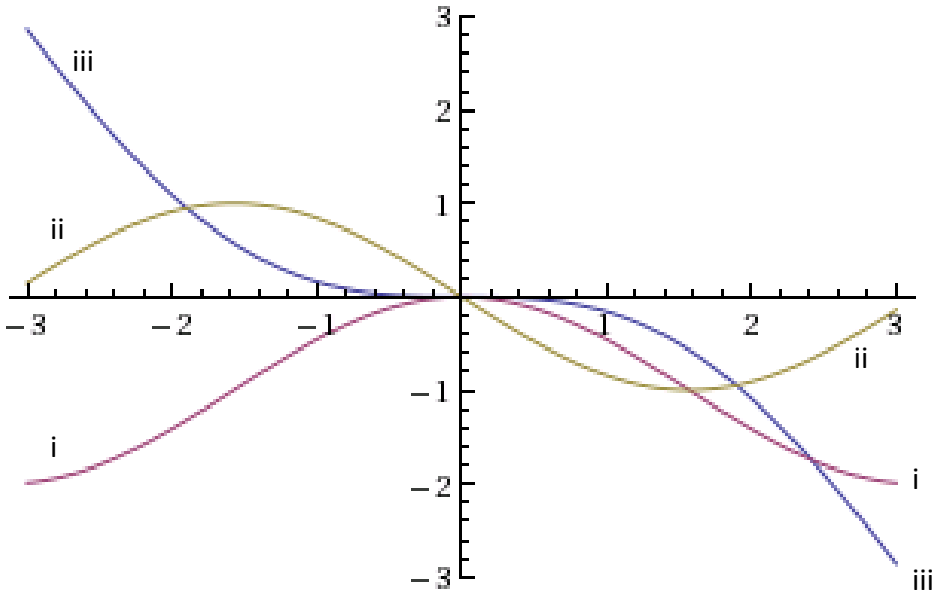
E) -2 F) $\dfrac{1}{2}$ G) $-\dfrac{1}{2}$ H) does not exist

10. An isosceles triangle has its vertex at the origin and its base parallel to the x-axis with vertices above the x-axis on the curve $y=27-x^2$. Find the largest area the triangle can have.

A) 40 unit^2
B) 42 unit^2
C) 48 unit^2
D) 50 unit^2
E) 54 unit^2
F) 56 unit^2
G) 60 unit^2
H) 64 unit^2



11. The curves (i), (ii), and (iii) in the graph below are the graphs of a function f and its first and second derivatives. Which curve is f, which is f', and which is f''? For full credit, you must explain.



A) (i) f (ii) f' (iii) f''
B) (i) f (ii) f'' (iii) f'
C) (i) f' (ii) f'' (iii) f
D) (i) f' (ii) f (iii) f''
E) (i) f'' (ii) f' (iii) f
F) (i) f'' (ii) f (iii) f'

12. Let

$$L=\int_1^{e^3} 3x^{-1}dx \qquad M=\int_0^4 \frac{5\sqrt{x^3}}{8}dx \qquad N=\int_0^{\ln 2} 6e^{3x}dx$$

Find $L+M-N$.

A) 1 B) 2 C) 3 D) 4
E) 5 F) 6 G) 7 H) 8

13. Evaluate

$$\int_5^{\sqrt{65}} \frac{4xdx}{\sqrt{x^2-16}}$$

A) 1 B) 2 C) 4 D) 7
E) 8 F) 10 G) 12 H) 16