

1. $f(x) = \begin{cases} \frac{2kx}{x-1}, & x < -1 \\ x-k, & x \geq -1 \end{cases}$, for what value of k is f(x) continuous?

- a. 2
- b. -1/2
- c. 2
- d. 0

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

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

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

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

d. $f'(x) = \frac{2x - 4}{3}$

e. $f'(x) = \frac{6x^2 + 9x - 4}{(3x + 1)^2}$

3. Find the derivative of $f(x) = 3x^2 \sin x$

a. $f'(x) = 6x^2 \cos x$

b. $f'(x) = 3x^2 \sin x + 6x \cos x$

c. $f'(x) = 6x \sin x + 3x^2 \cos x$

d. $f'(x) = 6x \cos x$

4. Use implicit differentiation to find $\frac{dy}{dx}$ if $2y - 3x = y^2 + x$.

- a. $\frac{2}{1-y}$
- b. $y + 2$
- c. $\frac{-1}{y}$
- d. $2y + x$

5. What is the minimum value of $f(x) = -x^2 + 3x$ on $[0, 4]$?

- a. 38
- b. 0
- c. 3/2
- d. 9/4
- e. -4

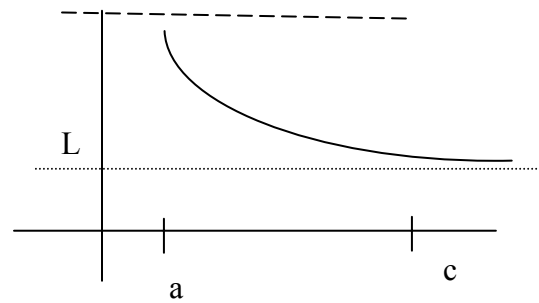
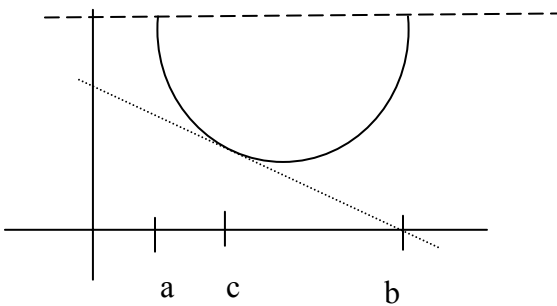
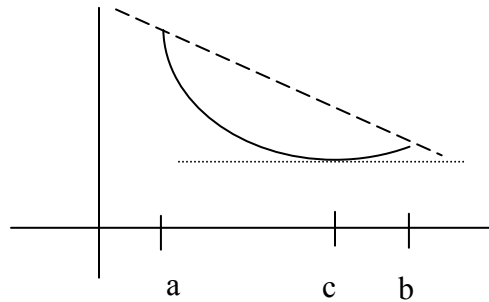
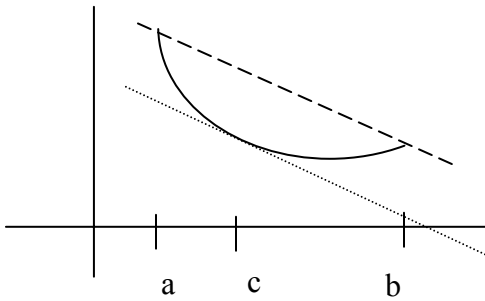
6. Find y' if $y = x^{\cos 3x}$ (hint: use logarithmic differentiation)

- a. $(\cos 3x)x^{\cos 3x-1}$
- b. $\cos 3x \ln x$
- c. $\frac{-3 \sin x}{x} x^{\cos 3x}$
- d. $\left(-3 \sin x \ln x + \frac{\cos 3x}{x}\right) x^{\cos 3x}$
- e. $-3 \sin x \ln x + \frac{\cos 3x}{x}$

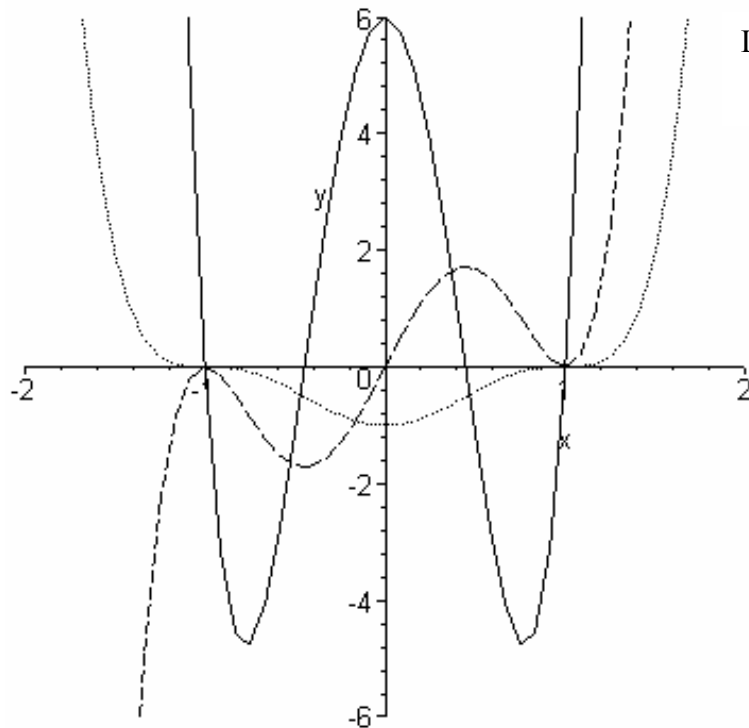
7. Find $\lim_{x \rightarrow \infty} \frac{x^2}{e^{3x}}$ (Hint: Use L'Hopital's rule)

- a. 0
- b. 1
- c. 2/3
- d. ∞
- e. $-\infty$
- f. does not exist

8. Which of the following best illustrates the Mean Value Theorem?



9.



Label each curve as f , f' , or f''

10. Estimate the area under the graph of $f(x) = x^2 + 5$ from $x = 1$ to $x = 7$ using 3 rectangles and the midpoint rule.

- a. 140
- b. 100
- c. 142
- d. 71
- e. 154

11. Find $\int 7 \sin x + 5e^x - 3x^{-1} dx$

- a. $7 \cos x + 5e^x - 3 \ln x + C$
- b. $-7 \cos x + 5e^x - 3 \ln x + C$
- c. $-7 \cos x + 5xe^{x-1} + 3x^{-2} + C$
- d. $7 \cos x + 5e^x + 3x^{-2} + C$

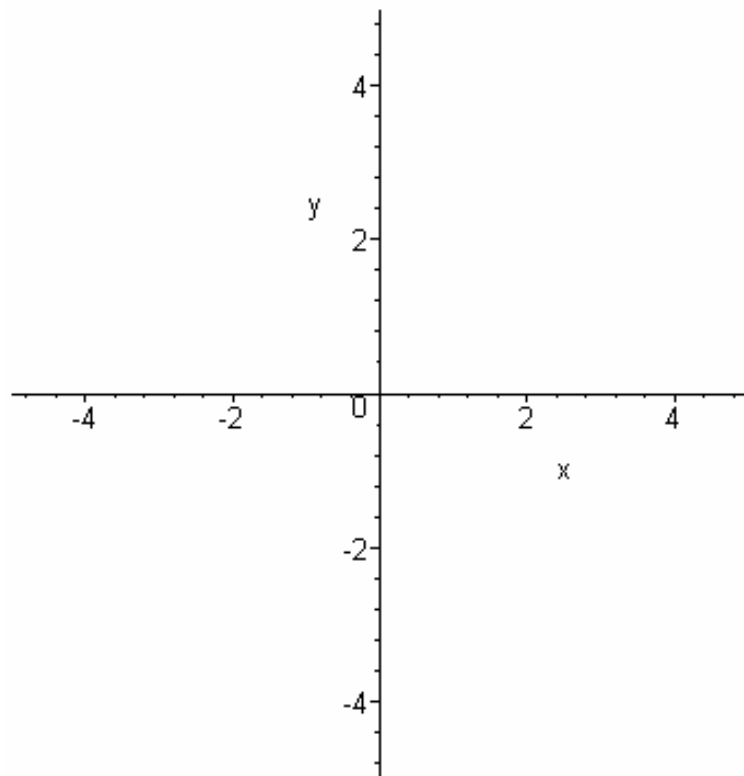
12. Evaluate $\int_1^2 x^4 dx$

- a. $31/5$
- b. $32/5$
- c. 15
- d. $33/5$

13. Find $f'(x)$ if $f(x) = \int_3^{x^2} 5t \sin t dt$

- a. $10x^4 \sin x^2$
- b. $5x^2 \sin x^2$
- c. $10x^3 \sin x^2$
- d. $5x \sin x$

14. Use the delta-epsilon definition of the limit to prove that $\lim_{x \rightarrow 1} (3x - 1) = 2$. Illustrate with a graph.



15. What is $\frac{d}{dx} \tan^{-1} x$? Prove it.

16. Sand is being poured into a sandlot at a rate of $20 \text{ ft}^3/\text{min}$. It forms a cone whose radius and height are always equal. How fast is the height of the pile increasing when the pile is 5 ft. high?

Ans _____

17. Someone wants to raise moose for the novelty meat market. This person has a bunch of old telephone poles and plenty of barbed wire for 12,000 feet of fencing. He wants to build a rectangular pen for the moose, using a nearby cliff for one side of the pen (so no fencing is needed for this side). What dimensions should the pen be to maximize its area?

Ans _____

18. Sketch the graph of $y = \frac{2x^2}{x^2 - 1}$, if $y' = \frac{-4x}{(x^2 - 1)^2}$ and $y'' = \frac{12x^2 + 4}{(x^2 - 1)^3}$. Be sure to *label* any asymptotes, intercepts, relative extrema or inflection points.

