

Review – Related Rates, Implicit differentiation, Graphs of the derivative
Calculus AB

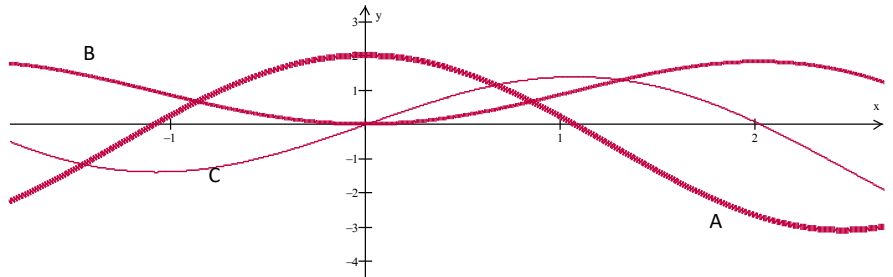
Find dy/dx .

1. $2x - 2y + 3y^2 - 3y^3 = 3$
2. $3y - 2xy = 4$
3. $\sin(x + y) - 2y = 3$
4. $x^2 + y^2 = 100$
5. $x^2y + 3xy^3 - x = 3$

Find the equation of the tangent line at the give value of x .

6. $x^2y - y = -3x$ at $x = 2$
7. $x^2y + 2y = 8$ when $x = 1$

8. From the graph name f, f', f''



Find the equation of the tangent line at the given point.

9. $x^2 + y^2 = 20$, $(2,4)$
10. $3(x^2 + y^2)^2 = 100xy$, $(3,1)$

11-12 Find the average rate of change on the given interval. Round to 3 decimal places.

11. $y = \sin(x^2 + 1)$, $[-1, 2]$
12. $y = \frac{3x - 2}{4x - 1}$, $[-2, 1]$

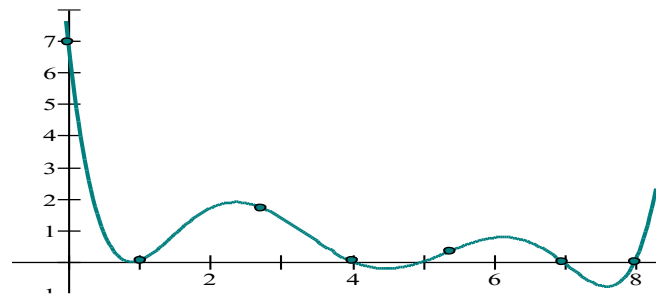
13. Find the slope of the tangent line for $2x^2y - x = y$ when $x = 1$.

Related Rates

14. A conical water tank with vertex down has a radius of 10 ft at the top and is 24 ft high. If water flows into the tank at a rate of $20 \text{ ft}^3 / \text{min}$, how fast is the depth of the water increasing when the water is 16 ft deep?
15. A balloon rises at the rate of 10 ft/sec from a point on the ground 100 feet from an observer. Find the rate of change of the angle of elevation of the balloon when the balloon is 100 ft above the ground.
16. A person is standing at the end of a pier 12 feet above the water and is pulling a rope attached to a rowboat at the waterline at a rate of 8 feet of rope per minute. How fast is the boat moving in the water when it is 16 feet from the pier?
17. Water is leaking from an inverted circular cone at the rate of 15 cubic cm per min. If the cone has a height of 30 cm and a radius of 20 cm, what is the rate that the water level is changing when the height is 8 cm?
18. Consider a piece of ice in the shape of a sphere that is melting at the rate of $6 \frac{\text{cm}^3}{\text{min}}$.
 - a. How fast is the radius changing at a moment when the radius is 3 cm?
 - b. How fast is the surface area of the ice changing at the same instant?

The cricket population in Pole Looted Wood has been monitored for the past 8 months. Y is the number of crickets in hundreds crickets per month. The rate of change of Y is recorded below.

19. Describe what is happening to the cricket population over the 8-month period.
20. Which of the following would have the most and the least crickets living in the woods: month 4, 5, 6, 7, 8.
21. Which has the most and least crickets of all the months?
22. If there were 100 crickets in the Pole Looted Woods when the research was started, make a graph of y .
23. At what point is the number of crickets decreasing the fastest?



Find the second derivative of each.

24. $x^3 + y^3 = 1$
25. $3x - 2xy + 1 = 0$

Name the absolute extrema on the given interval.

26. $f(x) = x^3 - 12x$; $[0, 4]$

27. $g(x) = 3x^{2/3} - 2x$; $[-1, 1]$

Name the critical numbers for each.

28. $g(x) = 2x - 3x^{2/3}$

29. $f(x) = x^2(x - 3)^3$

CALCULATOR. ROUND TO 3 DECIMAL PLACES.

30. Find the equation of the tangent line for $f(x) = x \cos(2x)$ at $x = 1.75$.

31. Find $f'(\frac{\pi}{3})$ for $f(x) = x \cos(2x)$.

32. Find the equation of the tangent line for $f(x) = \frac{2x^2 - \cos x}{3x - 1}$ at $x = 1.20$.

Answers

1. $\frac{dy}{dx} = \frac{2}{9y^2 - 6y + 2}$

2. $\frac{dy}{dx} = \frac{2y}{3 - 2x}$

3. $\frac{dy}{dx} = \frac{-\cos(x+y)}{\cos(x+y) - 2}$

4. $\frac{-x}{y}$

5. $\frac{1 - 2xy - 3y^3}{x^2 + 9xy^2}$

6. $y + 2 = \frac{5}{3}(x - 2)$

7. $y - \frac{8}{3} = -\frac{16}{9}(x - 1)$

8. B \rightarrow C \rightarrow A

9. $y - 4 = -1/2(x - 2)$

10. $y - 1 = 13/9(x - 3)$

11. -623

12. -5/27 or 0.185

13. -3

14. $\frac{9}{20\pi}$ ft/min

15. 1/20 rad/s

16. -10 ft/min

17. -.168 cm/min

18. a. -.053cm/min, -4 sq cm/min

19. Increasing on (0,4) (5,7)
Decreasing on (4,5) (7,8)

20. Most: 7

Least: 5

21. Most: 7

Least: 0

22.

23. ≈ 7.5

24. $-\frac{2x}{y^5}$

25. $\frac{-3 + 2y}{x^2}$

$f(0) = 0$

26. $f(2) = -16 \rightarrow \text{absmin}$

$f(4) = 16 \rightarrow \text{absmax}$

$f(-1) = 5 \rightarrow \text{absmax}$

27. $f(0) = 0 \rightarrow \text{absmin}$

$f(1) = 1$

28. 0, 1

29. 0, 3, 6/5

30. $y + 1.639 = 0.291(x - 1.75)$

31. -2.314

32. 1.087

