AP Calculus AB Chapter 3 Review   Name: ______________________________

1. Find $\frac{dy}{dx}$ if $\sqrt[5]{y} - \cos x = 10$.

2. If $x^2 + y^2 = 78$, find dy/dx.

3. If $\cos(xy) = 13$, find dy/dx.

4. Find $\frac{dy}{dx}$ if $y \sin x = 93$.

5. Find dy/dx if $y^6 = 5x$.

6. Find dy/dx by differentiating implicitly. $x^3 - y^7 = 7x$

7. Find dy/dx by differentiating implicitly. $x \sin y = x^4$

8. Use implicit differentiation to find $\frac{dy}{dx}$ if $x \ln y = 2$.

9. $y = 10 \ln 4x$. Find $\frac{dy}{dx}$.

10. $y = x^8 \log 4x$. Find $\frac{dy}{dx}$.

11. If $y = \sqrt[9]{\frac{x+2}{x+4}}$, find $\frac{dy}{dx}$ by logarithmic differentiation.

12. $y = \cos^{-1}(3x)$. Find $\frac{dy}{dx}$.

13. Find $\frac{dy}{dx}$ if $y = e^{-4x}\sin 3x$.

14. Find $\frac{dy}{dx}$ if $y = e^{-6x^7}$.

15. Find $\frac{dy}{dx}$ if $f(x) = \frac{e^{\ln 9x}}{9x}$.

16. Find $\frac{dy}{dx}$ if $f(x) = \sin\left(e^{8x}\right)$.

17. Find $\frac{dy}{dx}$ if $\tan y = e^{6x} + \ln 2x$.

18. The volume of a cylinder is given by $V = \pi r^2 h$. Find $\frac{dV}{dt}$ in terms of $\frac{dh}{dt}$. (Assume that r is a constant.)

19. A 10-ft ladder rests against a wall at $\pi/6$ radians. If it were to begin to slip, when the bottom of the ladder is moving at 0.04 ft/s, how fast would the top of the ladder be moving down the wall? (How fast would the height of the upper end of the ladder on the side of the wall be changing?)

20. Answer true or false. Suppose $z = 6yx$. Then $dz/dt = 6(dy/dt)(dx/dt)$.

21. Suppose $z = x^4 + y^2$. Then $dz/dt =$

22. The power in watts for a circuit is given by $P = I^2R$. How fast is the power changing if the resistance, R, of the circuit is 800 Ω, the current, I, is 5A, and the current is decreasing with respect to time at a rate of 0.005 A/s. (Assume R is a constant.)

23. Answer true or false. If $A = 3\pi r^3$, then $\dfrac{dr}{dt} = \left(\dfrac{1}{9\pi r^2}\right)\dfrac{dA}{dt}$.

24. A shark, looking for dinner, is swimming parallel to a straight beach and 50 feet offshore. The shark is swimming at the constant speed of 65 feet per second. At time $t = 0$, the shark is directly opposite a lifeguard station. How fast is the shark moving away from the lifeguard station when the distance between them is 130 feet?

25. A ladder 26 feet long is leaning against a wall. If the base of the ladder is moving away from the wall at the rate of 1/3 foot per second, at what rate will the top of the ladder be moving when the base of the ladder is 10 feet from the wall?

26. A spherical balloon is inflated so that its volume is increasing at the rate of 2 cubic feet per minute. How fast is the radius of the balloon increasing at the instant the radius is 1.1 foot?

$$\left[V = \frac{4}{3}\pi r^3\right]$$

27. Sand is falling into a conical pile so that the radius of the base of the pile is always equal to one half its altitude. If the sand is falling at the rate of 10 cubic feet per minute, how fast is the altitude of the pile increasing when the pile is 3 feet deep?

$$\left[V = \frac{1}{3}\pi r^2 h \text{ , where h is the altitude}\right]$$

28. The power in watts for a circuit is given by $P = I^2R$. How fast is the power changing if the resistance, R, of the circuit is 800 Ω, the current, I, is 4.5A, and the current is decreasing with respect to time at a rate of 0.015 A/s? (Assume the resistance is constant.)

29. A point P is moving along a curve whose equation is $y = \sqrt{x^2 + 64}$. When P = (15, 17) , y is increasing at a rate of 4 units/s. How fast is x changing?

30. A spherical balloon is inflated so that its volume is increasing at the rate of 40 cubic feet per minute. How fast is the surface area of the balloon increasing when the radius is 5 feet? [Use $V = \frac{4}{3}\pi r^3$ and $S = 4\pi r^2$.]

SKIP 31. A metal cone contracts as it cools. Assume the height of the cone is 20cm and the radius at the base of the cone is 5cm. If the height of the cone is decreasing at 5.0×10^{-5}cm per second, at what rate is the volume of the cone decreasing when its height is 18cm? (Assume the radius is held constant.)

$$\left[V = \frac{1}{3}\pi r^2 h\right]$$

32. Two ships leave port at noon. One ship sails north at 12 miles per hour and the other sails east at 9 miles per hour. At what rate are the two ships separating 5 hours later?

33. A baseball diamond is a square 90 feet on each side. A player is running from home to first base at the rate of 22 feet per second. At what rate is his distance from second base changing when he is 30 feet from first base? (Round your answer to three decimal places.)

34. Consider a rectangle where the sides are changing but the area is always 1,575 square inches. If one side changes at the rate of 4 inches per second, when it is 45 inches long, how fast is the other side changing?

35. A circular cylinder has a radius *r* and a height *h* feet. If the height and radius both increase at the constant rate of 9 feet per minute, at what rate is the lateral surface area increasing?

$$(S = 2\pi rh)$$

36. A straw is used to drink soda from the bottom of a cylindrical shaped cup. The diameter of the cup is 4 inches. The liquid is being consumed at the rate of 5 cubic inches per second. How fast is the level of the soda dropping?

$$\left[V = \pi r^2 h\right]$$

37. An aircraft is climbing at a 30° angle to the horizontal. Find the aircraft's speed if it is gaining altitude at the rate of 150 miles per hour.