

Find the derivative.

1) $s = t^7 \tan t - \sqrt{t}$

Find the limit, if it exists.

2) Let $f(x) = \frac{x^2 - 3x - 10}{x + 2}$. Find $\lim_{x \rightarrow -2} f(x)$.

Use l'Hopital's rule to find the limit.

3) $\lim_{x \rightarrow \infty} \frac{\ln(x + 3)}{\log_8 x}$

Find the limit.

4) $\lim_{x \rightarrow \infty} (\ln x)^{4/x}$

Use l'Hopital's rule to find the limit.

5) $\lim_{\theta \rightarrow 0} \frac{\sin \theta^3}{\theta}$

Find the derivative of the function.

6) $q = \sqrt{12r - r^3}$

Find $f'(x)$ for the following function.

7) $4x^9$

8) $6x \cdot 3x^3$

Solve the problem.

9) Find the equation of tangent line to $y = \cos x$ at $x = \frac{\pi}{2}$.

Find the derivative.

10) $r = 20 - \theta^4 \cos \theta$

Solve the initial value problem.

11) $\frac{d^2r}{dt^2} = \frac{4}{t^3}$; $\left. \frac{dr}{dt} \right|_{t=1} = -5$, $r(1) = 5$

Solve the problem.

12) Determine $\int (2x^2 + \frac{1}{x^3}) dx$

Find the derivative.

$$13) p = \frac{\sec q + \csc q}{\csc q}$$

Use implicit differentiation to find dy/dx.

$$14) \cos xy + x^7 = y^7$$

Find the derivative of the function.

$$15) h(\theta) = \sqrt{6 + \sin(8\theta)}$$

Evaluate the integral.

$$16) \int 9x^2 \sqrt[4]{10 + 2x^3} dx$$

Find the derivative of the function.

$$17) h(x) = \left(\frac{\cos x}{1 + \sin x} \right)^6$$

Find dy/dx by implicit differentiation.

$$18) xy + x + y = x^2y^2$$

Find the area between the curves.

$$19) y = 2x - x^2, y = 2x - 4$$

Solve the problem.

20) A man 6 ft tall walks at a rate of 5 ft/s away from a lamppost that is 23 ft high. At what rate is the length of his shadow changing when he is 60 ft away from the lamppost?

Find the value of the constant k that makes the function continuous.

$$21) g(x) = \begin{cases} x^2 - 8 & \text{if } x < 3 \\ 2kx & \text{if } x \geq 3 \end{cases}$$

Solve the problem.

22) A ball dropped from the top of a building has a height of $s = 144 - 16t^2$ meters after t seconds. How long does it take the ball to reach the ground? What is the ball's velocity at the moment of impact?

Solve the problem. Round your answer, if appropriate.

23) One airplane is approaching an airport from the north at 172 km/hr. A second airplane approaches from the east at 282 km/hr. Find the rate at which the distance between the planes changes when the southbound plane is 32 km away from the airport and the westbound plane is 16 km from the airport. Round to the nearest kilometer per hour.

Find the most general antiderivative.

$$24) \int \left(\frac{\sqrt{y}}{2} + \frac{4}{\sqrt{y}} \right) dy$$

Find the x -value of all points where the function has relative extrema. Find the value(s) of any relative extrema.

$$25) f(x) = 3x^4 + 16x^3 + 24x^2 + 32$$

Find the largest open intervals where the function is concave upward.

$$26) f(x) = x^3 - 3x^2 - 4x + 5$$

Find the derivative of the function.

$$27) y = 5 \sec^6 x$$

Find $\frac{dy}{dx}$.

$$28) \ln y = e^y \cos 3x$$

Find the integral.

$$29) \int -14x \sin x^2 dx$$

$$30) \int \frac{\cos x}{\sin^2 x} dx$$

$$31) \int 9 \csc^3 x \cot x dx$$

$$32) \int x^2 \sqrt{x^3 + 3} dx$$

Use the substitution formula to evaluate the integral.

$$33) \int_{-1}^0 \frac{3t}{(4+t^2)^4} dt$$

$$34) \int_{\pi/3}^{2\pi} 3 \cos^2 x \sin x dx$$

$$35) \int_0^{\pi/2} \frac{\cos x}{(4 + 3 \sin x)^3} dx$$

Answer Key

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$$1) \frac{ds}{dt} = t^7 \sec^2 t + 7t^6 \tan t - \frac{1}{2\sqrt{t}}$$

$$2) -7$$

$$3) \ln 8$$

$$4) 1$$

$$5) 0$$

$$6) \frac{dq}{dr} = \frac{12 - 3r^2}{2\sqrt{12r - r^3}}$$

$$7) 4x^9(9x^8 \ln 4)$$

$$8) 6 \cdot 3x^3(3x^3 \ln 3 + 1)$$

$$9) y = -x + \frac{\pi}{2}$$

$$10) \frac{dr}{d\theta} = -4\theta^3 \cos \theta + \theta^4 \sin \theta$$

$$11) r = \frac{2}{t} - 3t + 6$$

$$12) \frac{2}{3}x^3 - \frac{1}{2x^2} + C$$

$$13) \frac{dp}{dq} = \sec^2 q$$

$$14) \frac{7x^6 - y \sin xy}{7y^6 + x \sin xy}$$

$$15) h'(\theta) = \frac{4 \cos(8\theta)}{\sqrt{6 + \sin(8\theta)}}$$

$$16) \frac{6}{5}(10 + 2x^3)^{5/4} + C$$

$$17) h'(x) = \frac{-6 \cos^5 x}{(1 + \sin x)^6}$$

$$18) \frac{2xy^2 - y - 1}{-2x^2y + x + 1}$$

$$19) \frac{32}{3}$$

$$20) \frac{30}{17} \text{ ft/s}$$

$$21) k = \frac{1}{6}$$

$$22) 3 \text{ sec, } -96 \text{ m/sec}$$

$$23) -280 \text{ km/hr}$$

$$24) \frac{1}{3}y^{3/2} + 8\sqrt{y} + C$$

$$25) \text{Relative minimum of 32 at } 0.$$

$$26) (1, \infty)$$

Answer Key

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$$27) \frac{dy}{dx} = 30 \tan x \sec^6 x$$

$$28) \frac{-3ye^y \sin 3x}{1 - ye^y \cos 3x}$$

$$29) 7 \cos x^2 + C$$

$$30) -\csc x + C$$

$$31) -3 \csc^3 x + C$$

$$32) \frac{2}{9}(x^3 + 3)^{3/2} + C$$

$$33) -\frac{61}{16000}$$

$$34) -\frac{7}{8}$$

$$35) \frac{11}{1568}$$