WebAssign
3.4-3.5 Regla Cadena y Derivación Implicit (Homework)

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Diferencial, section B, Spring 2019
Instructor: Christiaan Ketelaar

Current Score : 39 / 33 **Due :** Friday, March 22, 2019 11:59 PM CST**Last Saved : n/a Saving... ()**

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1. 2/2 points | Previous AnswersSCalcET8 3.4.003.

Write the composite function in the form $f(g(x))$. [Identify the inner function $u = g(x)$ and the outer function $y = f(u)$.]

$$y = \tan(\pi x)$$

$(g(x), f(u)) = \Big($
$$πx, *tan*(*u*)

$\boxed{\pi x, \tan(u)}\Big)$

Find the derivative dy/dx.

$\frac{dy}{dx} =$
$$*sec*2(π*x*)(π)

$\boxed{\pi \sec^2(\pi x)}$

Solution or Explanation

Let $u = g(x) = \pi x$ and $y = f(u) = \tan(u)$. Then $\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx} = (\sec^2(u))(\pi) = \pi \sec^2(\pi x)$.

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2. 1/1 points | Previous AnswersSCalcET8 3.4.007.

Find the derivative of the function.

$$F(x) = (3x^6 + 4x^3)^4$$

$F'(x) =$
$$4(3*x*6+4*x*3)3(18*x*5+12*x*2)

$\boxed{24x^{11}\left(3x^3+2\right)\left(3x^3+4\right)^3}$

Solution or Explanation

$F(x) = (3x^6 + 4x^3)^4 \Rightarrow F'(x) = 4(3x^6 + 4x^3)^3 \cdot \frac{d}{dx}(3x^6 + 4x^3) = 4(3x^6 + 4x^3)^3(18x^5 + 12x^2)$. We can factor as follows:
$4(x^3)^3(3x^3 + 4)^3 6x^2(3x^3 + 2) = 24x^{11}(3x^3 + 4)^3(3x^3 + 2)$.

3. 1/1 points | Previous AnswersSCalcET8 3.4.011.

Find the derivative of the function.

$$f(\theta) = \cos(\theta^2)$$

$f'(\theta) =$

$$-sin(\theta2)2\theta

$\boxed{-2\theta \sin\left(\theta^2\right)}$

Solution or Explanation

$$f(\theta) = \cos(\theta^2) \quad \Rightarrow \quad f'(\theta) = -\sin(\theta^2) \cdot \frac{d}{d\theta}(\theta^2) = -\sin(\theta^2) \cdot (2\theta) = -2\theta \sin(\theta^2)$$

4. 1/1 points | Previous AnswersSCalcET8 3.4.021.

Find the derivative of the function.

$$y = \sqrt{\frac{x}{x+9}}$$

$y' =$

$$12(xx+9)−12(9(x+9)2)

$\boxed{\dfrac{9}{2\sqrt{x}(x+9)^{3/2}}}$

Solution or Explanation

$$y = \sqrt{\frac{x}{x+9}} = \left(\frac{x}{x+9}\right)^{1/2} \quad \Rightarrow$$

$$y' = \frac{1}{2}\left(\frac{x}{x+9}\right)^{-1/2} \frac{d}{dx}\left(\frac{x}{x+9}\right) = \frac{1}{2}\left(\frac{x^{-1/2}}{(x+9)^{-1/2}}\right)\left(\frac{(x+9)(1) - x(1)}{(x+9)^2}\right)$$

$$= \frac{1}{2}\left(\frac{(x+9)^{1/2}}{x^{1/2}}\right)\left(\frac{9}{(x+9)^2}\right) = \frac{9}{2\sqrt{x}(x+9)^{3/2}}$$

5. 1/1 points | Previous AnswersSCalcET8 3.4.023.

Find the derivative of the function.

$$y = e^{\tan(\theta)}$$

$y' =$

$$etan(\theta)(sec2(\theta))

$\boxed{e^{\tan(\theta)} \sec^2(\theta)}$

Solution or Explanation

$$y = e^{\tan(\theta)} \quad \Rightarrow \quad y' = e^{\tan(\theta)} \frac{d}{d\theta}(\tan(\theta)) = (\sec^2(\theta))e^{\tan(\theta)}$$

6. 1/1 points | Previous AnswersSCalcET8 3.4.031.

Find the derivative of the function.

$$F(t) = e^{3t\sin(2t)}$$

$F'(t) =$
$$e3tsin(2t)(3sin(2t)+6tcos(2t))

$e^{3t\sin(2t)}\left(6t\cos(2t)+3\sin(2t)\right)$

Solution or Explanation

By the example, $F(t) = e^{3t\sin(2t)} \Rightarrow$

$F'(t) = e^{3t\sin(2t)}(3t\sin(2t))' = e^{3t\sin(2t)}(3t \cdot 2\cos(2t) + \sin(2t) \cdot 3) = e^{3t\sin(2t)}(6t\cos(2t) + 3\sin(2t))$

7. 1/1 points | Previous AnswersSCalcET8 3.4.041.

Find the derivative of the function.

$$f(t) = \cos^2(e^{\cos^2(t)})$$

$f'(t) =$
$$2(cos(ecos2(t)))(−sin(ecos2(t)))(ecos2(t))(2cos(t))(−sin(t))

$4\cos\left(e^{\cos^2(t)}\right)\sin\left(e^{\cos^2(t)}\right)e^{\cos^2(t)}\cos(t)\sin(t)$

Solution or Explanation

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8. 1/0 points | Previous AnswersSCalcET8 3.4.042.

Find the derivative of the function.

$$y = \sqrt{7x + \sqrt{7x + \sqrt{7x}}}$$

$y' =$
$${12√7x+√7x+√7x}{7+7+72√7x2√7x+√7x}

$$\frac{\frac{\frac{1}{2}\sqrt{7}\sqrt{\frac{1}{x}}+7}{2\sqrt{7x+\sqrt{7}\sqrt{x}}}+7}{2\sqrt{7x+\sqrt{7x+\sqrt{7}\sqrt{x}}}}$$

Solution or Explanation

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9. 2/2 points | Previous AnswersSCalcET8 3.4.050.

Find y' and y''.

$$y = e^{4e^x}$$

$$(e4ex)(4ex)

y' =

$4e^{x+4e^x}$

$$(e4ex)(4ex)(4ex)+(e4ex)(4ex)

y'' =

$4e^{x+4e^x}\left(4e^x+1\right)$

Solution or Explanation

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10. 1/1 points | Previous AnswersSCalcET8 3.4.053.

Find an equation of the tangent line to the curve at the given point.

$y = \sin(\sin(x))$, $(\pi, 0)$

$$y=−1(x−π)

$y=\pi-x$

Solution or Explanation

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11. 1/1 points | Previous AnswersSCalcET8 3.4.062.

If $h(x) = \sqrt{7 + 6f(x)}$, where $f(4) = 7$ and $f'(4) = 3$, find $h'(4)$.

$h'(4)$ = 9/7 9/7

Solution or Explanation

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12. 2/2 points | Previous Answers SCalcET8 3.4.069.

Suppose f is differentiable on $\mathbb{R}$. Let $F(x) = f(e^x)$ and $G(x) = e^{f(x)}$. Find expressions for the following.

(a) $F'(x)$

- $f'(e^x)$
- $f(e^x)e^x$
- $f'(e^x)xe^x$
- $f(e^x)xe^x$
- $f'(e^x)e^x$ (selected) ✓

(b) $G'(x)$

- $e^{f(x)}f(x)$
- $e^{f'(x)}$
- $e^{f(x)}f'(x)$ (selected)
- $e^{f'(x)}f(x)$
- $e^{f'(x)}f'(x)$

✓

Solution or Explanation

(a) $F(x) = f(e^x) \quad \Rightarrow \quad F'(x) = f'(e^x)\dfrac{d}{dx}(e^x) = f'(e^x)e^x$

(b) $G(x) = e^{f(x)} \quad \Rightarrow \quad G'(x) = e^{f(x)}\dfrac{d}{dx}f(x) = e^{f(x)}f'(x)$

13. 1/1 points | Previous Answers SCalcET8 3.4.073.

If $F(x) = f(6f(4f(x)))$, where $f(0) = 0$ and $f'(0) = 1$, find $F'(0)$.

$F'(0) =$ 24 ✓ 24

Solution or Explanation

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14. 1/0 points | Previous Answers SCalcET8 3.4.079.

The displacement of a particle on a vibrating string is given by the equation $s(t) = 3 + \frac{1}{4}\sin(3\pi t)$ where s is measured in centimeters and t in seconds. Find the velocity of the particle after t seconds.

$v(t) =$
$$[14cos(3πt)][3π]

✓ $\dfrac{3\pi}{4}\cos(3\pi t)$ cm/s

Solution or Explanation

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15. 1/0 points | Previous Answers SCalcET8 3.4.071.

Let $r(x) = f(g(h(x)))$, where $h(1) = 3$, $g(3) = 5$, $h'(1) = 3$, $g'(3) = 3$, and $f\,'(5) = 5$. Find $r'(1)$.

$r'(1) =$ 45 ✔ 45

Solution or Explanation

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16.3/3 points | Previous AnswersSCalcET8 3.4.083.MI.

The motion of a spring that is subject to a frictional force or a damping force (such as a shock absorber in a car) is often modeled by the product of an exponential function and a sine or cosine function. Suppose the equation of motion of a point on such a spring is

$s(t) = 4e^{-1.6t}\sin(2\pi t)$

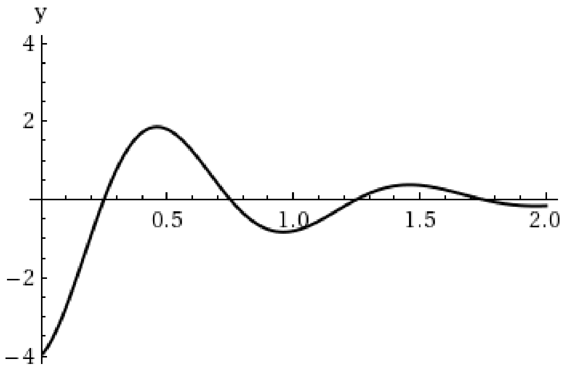
where s is measured in centimeters and t in seconds. Find the velocity after t seconds.

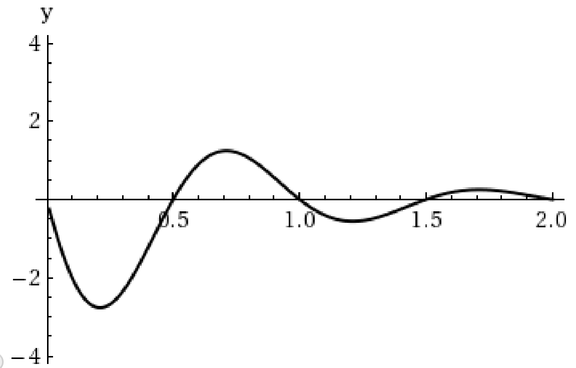
$v(t) =$

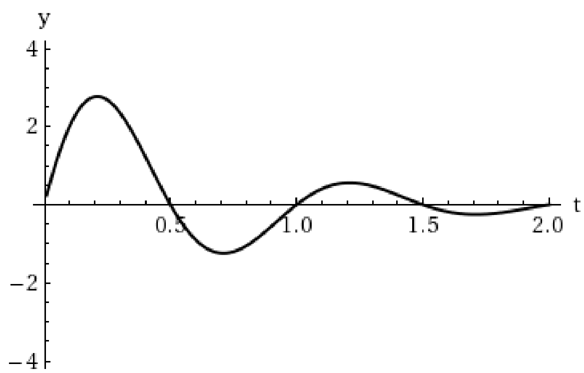
`$$4[e−1.6t(−1.6)(sin(2πt))+e−1.6t(cos(2πt)(2π))]`

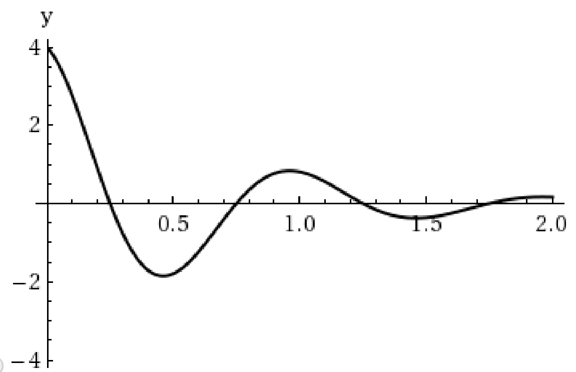
$\boxed{4e^{-1.6t}\left(2\pi\cos(2\pi\ t) - 1.6\sin(2\pi\ t)\right)}$

Graph the position function for $0 \le t \le 2$.

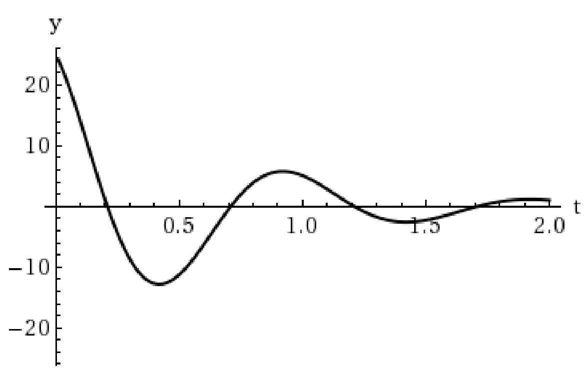


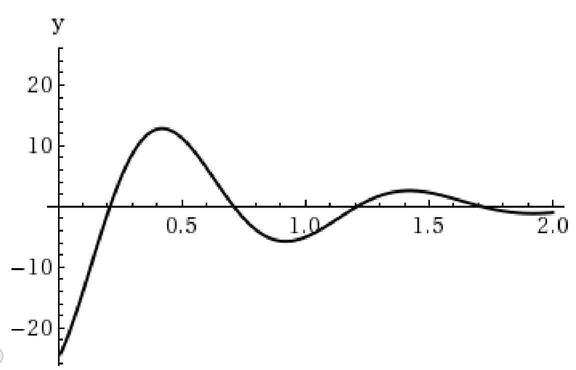


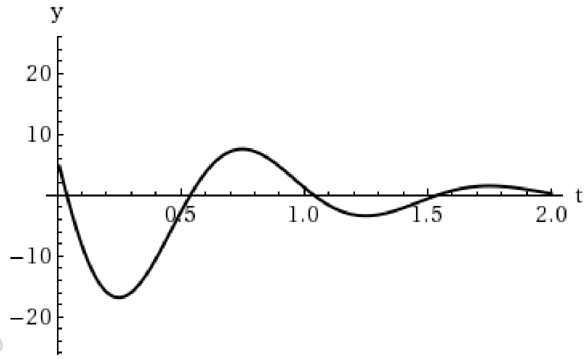


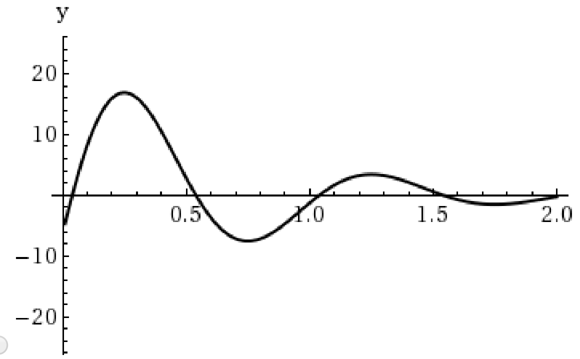


Graph the velocity function for $0 \le t \le 2$.









Solution or Explanation
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17. 1/1 points | Previous Answers SCalcET8 3.4.505.XP.

Find the derivative of the function.

$$y = \left(\frac{x^2 + 2}{x^2 - 2}\right)^6$$

$y' =$

$$6{x2+2x2−2}5[(2x)(x2−2)−(x2+2)(2x)(x2−2)2]

$$\boxed{\frac{-48x\left(x^2+2\right)^5}{\left(x^2-2\right)^7}}$$

Solution or Explanation
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18. 2/2 points | Previous Answers SCalcET8 3.4.515.XP.

Find the derivative of the function.

$$y = \cos(\cos(\cos(x)))$$

$y' =$

$$[−sin(cos(cos(x)))][−sin(cos(x))][−sin(x)]

$$\boxed{-\sin\left(\cos\left(\cos\left(x\right)\right)\right)\sin\left(\cos\left(x\right)\right)\sin\left(x\right)}$$

Solution or Explanation
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19. 1/0 points | Previous Answers SCalcET8 3.4.516.XP.

Find the derivative of the function.

$$y = 5^{4^{x^2}}$$

$y' =$
$$[54x2ln(5)][4x2ln(4)][2x]

$5^{4^{x^2}} \ln(5)\, 4^{x^2} \ln(4)\, (2x)$

Solution or Explanation
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20. 2/2 points | Previous Answers SCalcET8 3.5.001.

Consider the following equation.

$4x^2 - y^2 = 3$

(a) Find y' by implicit differentiation.

$y' =$
$$−8x−2y

$\frac{4x}{y}$

(b) Solve the equation explicitly for y and differentiate to get y' in terms of x.

$y' = \pm$
$$[12(4x2−3)−12][8x]

$\frac{4x}{\sqrt{4x^2 - 3}}$

Solution or Explanation

(a) $\frac{d}{dx}(4x^2 - y^2) = \frac{d}{dx}(3) \Rightarrow 8x - 2yy' = 0 \Rightarrow 2yy' = 8x \Rightarrow y' = \frac{4x}{y}$

(b) $4x^2 - y^2 = 3 \Rightarrow y^2 = 4x^2 - 3 \Rightarrow y = \pm\sqrt{4x^2 - 3}$, so $y' = \pm\frac{1}{2}(4x^2 - 3)^{-1/2}(8x) = \pm\frac{4x}{\sqrt{4x^2 - 3}}$.

From part (a), $y' = \frac{4x}{y} = \frac{4x}{\pm\sqrt{4x^2 - 3}}$, which agrees with part (b).

21. 1/1 points | Previous Answers SCalcET8 3.5.005.

Find dy/dx by implicit differentiation.

$$x^2 - 8xy + y^2 = 8$$

$y' =$
$$8y−2x−8x+2y

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

Solution or Explanation

$$\frac{d}{dx}(x^2 - 8xy + y^2) = \frac{d}{dx}(4) \Rightarrow 2x - 8[xy' + y(1)] + 2yy' = 0$$
$$\Rightarrow 2yy' - 8xy' = 8y - 2x$$
$$\Rightarrow y'(2y - 8x) = 8y - 2x$$
$$\Rightarrow y' = \frac{4y - x}{y - 4x}$$

22. 1/1 points | Previous Answers SCalcET8 3.5.011.

Find dy/dx by implicit differentiation.

$$y\cos(x) = 3x^2 + 2y^2$$

$y' =$
$$6x+ysin(x)cos(x)−4y

$$\frac{y\sin(x) + 6x}{\cos(x) - 4y}$$

Solution or Explanation

$$\frac{d}{dx}(y\cos(x)) = \frac{d}{dx}(3x^2 + 2y^2) \Rightarrow y(-\sin(x)) + \cos(x)\cdot y' = 6x + 4yy' \Rightarrow \cos(x)\cdot y' - 4yy' = 6x + y\sin(x) \Rightarrow$$
$$y'(\cos(x) - 4y) = 6x + y\sin(x) \Rightarrow y' = \frac{6x + y\sin(x)}{\cos(x) - 4y}$$

23. 2/0 points | Previous Answers SCalcET8 3.5.020.

Find dy/dx by implicit differentiation.

$$\tan(x - y) = \frac{y}{9 + x^2}$$

$y' =$
$$x4sec2(x−y)+18x2sec2(x−y)+81sec2(x−y)+2xyx2+9+x4sec2(x−y)+18x2sec2(x−y)+81sec2(x−y)

$$\frac{(9 + x^2)\sec^2(x - y) + 2x\tan(x - y)}{1 + (9 + x^2)\sec^2(x - y)}$$

Solution or Explanation

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24. 1/1 points | Previous Answers SCalcET8 3.5.025.

Use implicit differentiation to find an equation of the tangent line to the curve at the given point.

$y \sin(12x) = x \cos(2y), \quad (\pi/2, \pi/4)$

$y =$
$$−3(x−п2)+п4

$-3x+\frac{7}{4}\pi$

Solution or Explanation

$y \sin(12x) = x\cos(2y) \Rightarrow y \cdot \cos(12x) \cdot 12 + \sin(12x) \cdot y' = x(-\sin(2y) \cdot 2y') + \cos(2y) \cdot 1 \Rightarrow$
$\sin(12x) \cdot y' + 2x \sin(2y) \cdot y' = -12y\cos(12x) + \cos(2y) \Rightarrow y'(\sin(12x) + 2x\sin(2y)) = -12y\cos(12x) + \cos(2y) \Rightarrow$
$y' = \dfrac{-12y\cos(12x) + \cos(2y)}{\sin(12x) + 2x\sin(2y)}$. When $x = \dfrac{\pi}{2}$ and $y = \dfrac{\pi}{4}$, we have $y' = \dfrac{(-3\pi)(1) + 0}{0 + \pi \cdot 1} = \dfrac{-3\pi}{\pi} = -3$, so an equation of the tangent line is $y - \dfrac{\pi}{4} = -3\left(x - \dfrac{\pi}{2}\right)$, or $y = -3x + \dfrac{7}{4}\pi$.

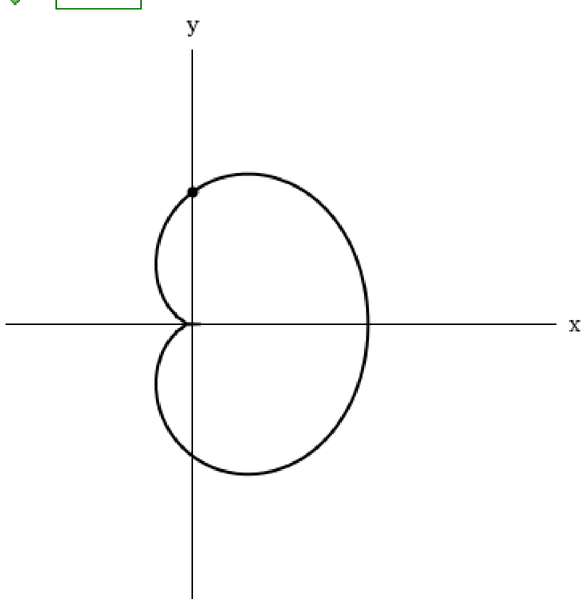
25. 1/1 points | Previous Answers SCalcET8 3.5.029.

Use implicit differentiation to find an equation of the tangent line to the curve at the given point.

$x^2 + y^2 = (4x^2 + 2y^2 - x)^2$
(0, 0.5)
(cardioid)

$y =$
$$1(x)+0.5

$x+\frac{1}{2}$



Solution or Explanation

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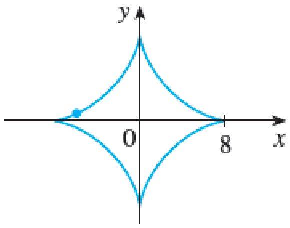
26. 1/1 points | Previous Answers SCalcET8 3.5.030.

Use implicit differentiation to find an equation of the tangent line to the curve at the given point.

$x^{2/3} + y^{2/3} = 4$
$(-3\sqrt{3}, 1)$
(astroid)

$y =$
$$(−1^3√−3√3)(x+3√3)+1

$\boxed{\left(\frac{1}{\sqrt{3}}\right)x + 4}$



Solution or Explanation
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27. 1/1 points | Previous Answers SCalcET8 3.5.035.

Find y'' by implicit differentiation.

$x^2 + 4y^2 = 4$

$y'' =$
$$−14y3

$\boxed{-\frac{1}{4y^3}}$

Solution or Explanation

$x^2 + 4y^2 = 4 \;\Rightarrow\; 2x + 8yy' = 0$
$\Rightarrow\; y' = -x/(4y)$
$\Rightarrow\; y'' = -\frac{1}{4}\frac{y \cdot 1 - x \cdot y'}{y^2} = -\frac{1}{4}\frac{y - x[-x/(4y)]}{y^2} = -\frac{1}{4}\frac{4y^2 + x^2}{4y^3} = -\frac{1}{4}\frac{4}{4y^3}$

$\left[\begin{array}{l}\text{since } x \text{ and } y \text{ must satisfy the} \\ \text{original equation } x^2 + 4y^2 = 4\end{array}\right]$

Thus, $y'' = -\frac{1}{4y^3}$.

28.0/0 points | Previous AnswersSCalcET8 3.5.040.

If $x^2 + xy + y^3 = 1$, find the value of y''' at the point where $x = 1$.
$$2(27y4−81y3+6y2+12y−1)(3y2+1)4

✗ 42

Solution or Explanation

If $x = 1$ in $x^2 + xy + y^3 = 1$, then we get $1 + y + y^3 = 1 \Rightarrow y^3 + y = 0 \Rightarrow y(y^2 + 1) \Rightarrow y = 0$, so the point where $x = 1$ is (1, 0). Differentiating implicitly with respect to x gives us $2x + xy' + y \cdot 1 + 3y^2 \cdot y' = 0$. Substituting 1 for x and 0 for y gives us $2 + y' + 0 + 0 = 0 \Rightarrow y' = -2$. Differentiating $2x + xy' + y + 3y^2y' = 0$ implicitly with respect to x gives us $2 + xy'' + y' \cdot 1 + y' + 3(y^2y'' + y' \cdot 2yy') = 0$. Now substitute 1 for x, 0 for y, and -2 for y'. $2 + y'' + (-2) + (-2) + 3(0 + 0) = 0 \Rightarrow y'' = 2$. Differentiating $2 + xy'' + 2y' + 3y^2y'' + 6y(y')^2 = 0$ implicitly with respect to x gives us $xy''' + y'' \cdot 1 + 2y'' + 3(y^2y''' + y'' \cdot 2yy') + 6[y \cdot 2y'y'' + (y')^2y'] = 0$. Now substitute 1 for x, 0 for y, -2 for y', and 2 for y''. $y''' + 2 + 4 + 3(0 + 0) + 6[0 + (-8)] = 0 \Rightarrow y''' = -2 - 4 + 48 = 42$.

29.3/3 points | Previous AnswersSCalcET8 3.5.502.XP.

Consider the following.

$\cos(x) + \sqrt{y} = 6$

(a) Find y' by implicit differentiation.

$y' =$
$$sin(x)12(y)−12

✓ $2\sqrt{y}\sin(x)$

(b) Solve the equation explicitly for y and differentiate to get y' in terms of x.

$y' =$
$$2(6−cos(x))(sin(x))

✓ $2\sin(x)(6-\cos(x))$

(c) Check that your solutions to parts (a) and (b) are consistent by substituting the expression for y into your solution for part (a).

$y' =$
$$sin(x)12((6−cos(x))2)−12

✓ $2\sin(x)(6-\cos(x))$

Solution or Explanation

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30. 1/1 points | Previous Answers SCalcET8 3.5.508.XP.

Find *dy*/*dx* by implicit differentiation.

$5 \cos(x) \sin(y) = 1$

$y' =$
$$5sin(x)sin(y)5cos(x)cos(y)

$\tan(x)\tan(y)$

Solution or Explanation
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