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Section 2.1

1. Find the slope m of the line tangent to the graph of the function $f(x) = 5 - 6x$ at the point $(-1, 11)$.

a. $m = -6$
b. $m = -5$
c. $m = 5$
d. $m = 6$
e. $m = -11$

ANSWER: a

2. Find the slope m of the line tangent to the graph of the function $g(x) = 8 - x^2$ at the point $(5, -17)$.

a. $m = 5$
b. $m = 8$
c. $m = -10$
d. $m = -17$
e. $m = -16$

ANSWER: c

3. Find the derivative of the function $g(x) = -1$ by the limit process.

a. $g'(x) = 1$
b. $g'(x) = x$
c. $g'(x) = -x$
d. $g'(x) = 0$
e. $g'(x) = -1$

ANSWER: d

4. Find the derivative of the function $h(s) = 5 + \frac{7}{8}s$ by the limit process.

a. $h'(s) = 5$
b. $h'(s) = 5s + \frac{7}{8}s^2$
c. $h'(s) = \frac{7}{8}$
d. $h'(s) = \frac{47}{8}$
e. $h'(s) = 5s + \frac{7}{8}$

ANSWER: c

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Section 2.1

5. Find the derivative of the following function $f(x) = -2x^2 + 8x - 10$ using the limiting process.

a. $f'(x) = -4x + 8$
b. $f'(x) = -2x + 8$
c. $f'(x) = -4x + 8x - 10$
d. $f'(x) = -2x - 8$
e. $f'(x) = -4x - 8$

ANSWER: a

6. Find the derivative of the following function using the limiting process.

$f(x) = -5x^2 - 4x$

a. $f'(x) = -5$
b. $f'(x) = -5x - 4$
c. $f'(x) = -10x + 4$
d. $f'(x) = -10x$
e. $f'(x) = -10x - 4$

ANSWER: e

7. Find the derivative of the following function using the limiting process.

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

a. $f'(x) = 15x^2 + 6x$
b. $f'(x) = 10x^2 - 6x$
c. $f'(x) = 15x^2 - 6x - 4$
d. $f'(x) = 10x^2 + 6x$
e. $f'(x) = 15x^2 - 6x$

ANSWER: e

8. Find the derivative of the following function using the limiting process.

$f(x) = \frac{7}{x+7}$

a. $f'(x) = \frac{7}{(x-7)^2}$

b. $f'(x) = -\dfrac{7x}{(x+7)^2}$

c. $f'(x) = -\dfrac{7}{(x+7)^2}$

d. $f'(x) = \dfrac{7}{(x+7)^2}$

e. $f'(x) = -\dfrac{7}{(x-7)^2}$

ANSWER: c

9. Find the derivative of the following function using the limiting process.

$f(x) = \dfrac{1}{x^2}$

a. $f'(x) = \dfrac{2}{x^3}$

b. $f'(x) = -\dfrac{2}{x}$

c. $f'(x) = \dfrac{2}{x}$

d. $f'(x) = -\dfrac{3}{x^3}$

e. $f'(x) = -\dfrac{2}{x^3}$

ANSWER: e

10. Find the derivative of the function $f(x) = \sqrt{5x+6}$ using the limiting process.

a. $f'(x) = \dfrac{5}{2\sqrt{5x+6}}$

b. $f'(x) = -\dfrac{5}{2\sqrt{5x+6}}$

c. $f'(x) = -\dfrac{5x}{\sqrt{5x+6}}$

d. $f'(x) = \dfrac{5}{2}\sqrt{5x+6}$

e. $f'(x) = -\dfrac{5}{\sqrt{5x+6}}$

ANSWER: a

11. Find the derivative of the function $f(x) = \dfrac{18}{\sqrt{x}}$ by the limit process.

a. $f'(x) = \dfrac{18}{x}$

b. $f'(x) = -\dfrac{9\sqrt{x}}{x}$

c. $f'(x) = \dfrac{9}{x}$

d. $f'(x) = -\dfrac{9}{x\sqrt{x}}$

e. $f'(x) = -\dfrac{18}{x\sqrt{x}}$

ANSWER: d

12. Find an equation of the tangent line to the graph of the function $f(x) = x^2 + 3x + 5$ at the point $(-4, 9)$.

a. $y = -11$
b. $y = -5x - 11$
c. $y = 11x$
d. $y = 5x$
e. $y = -11x - 35$

ANSWER: b

13. Find an equation of the tangent line to the graph of the function $f(x) = \sqrt{x - 7}$ at the point $(23, 4)$.

a. $y = \dfrac{x}{4} + \dfrac{9}{4}$

b. $y = \dfrac{x}{8} + \dfrac{9}{8}$

c. $y = \dfrac{x}{8} + \dfrac{23}{4}$

d. $y = \dfrac{x}{4} + \dfrac{23}{4}$

e. $y = \dfrac{x}{8} + \dfrac{23}{8}$

ANSWER: b

Section 2.1

14. Find an equation of the line that is tangent to the graph of the function $f(x) = 6x^2$ and parallel to the line $12x + y + 7 = 0$.

a. $12x + y + 6 = 0$
b. $14x - y + 7 = 0$
c. $12x - y + 6 = 0$
d. $12x + y + 7 = 0$
e. $14x + y + 7 = 0$

ANSWER: a

15. Find an equation of the line that is tangent to the graph of f and parallel to the given line.

$f(x) = 5x^3$, $15x - y + 2 = 0$

a. $y = -15x + 10$
b. $y = -5x + 10$
c. $y = 15x - 5$ and $y = 15x + 5$
d. $y = -15x - 10$
e. $y = 15x - 10$ and $y = 15x + 10$

ANSWER: e

16. Find an equation of the line that is tangent to the graph of the function $f(x) = \frac{11}{\sqrt{x}}$ and parallel to the line $11x + 2y - 12 = 0$.

a. $11x + y + 33 = 0$
b. $6x + y - 12 = 0$
c. $6x + 2y + 6 = 0$
d. $11x + 2y - 33 = 0$
e. $11x + 2y - 22 = 0$

ANSWER: d

17. The graph of the function *f* is given below. Select the graph of f'.

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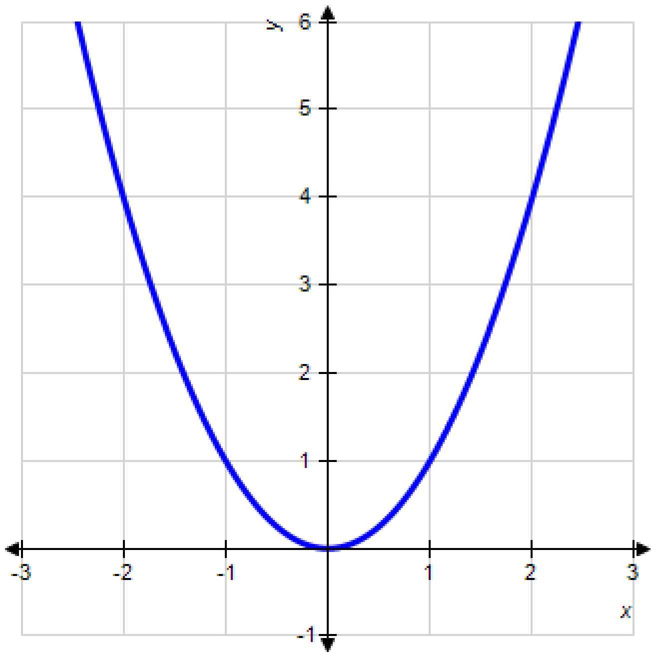
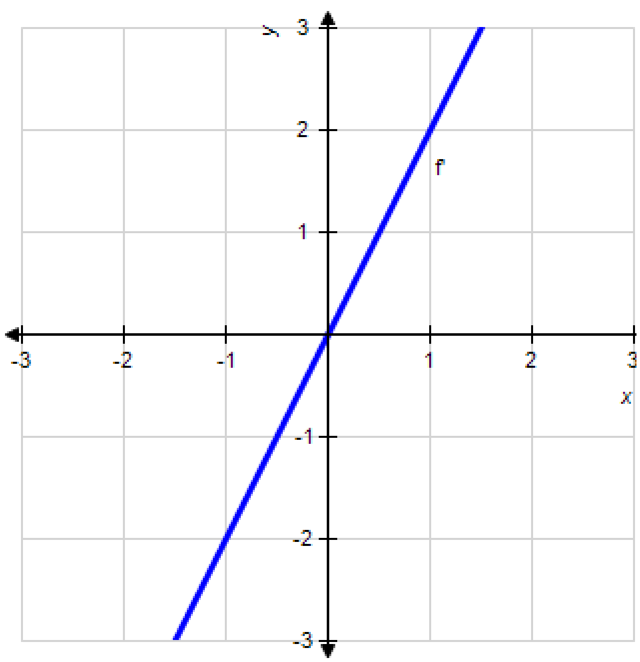
Section 2.1

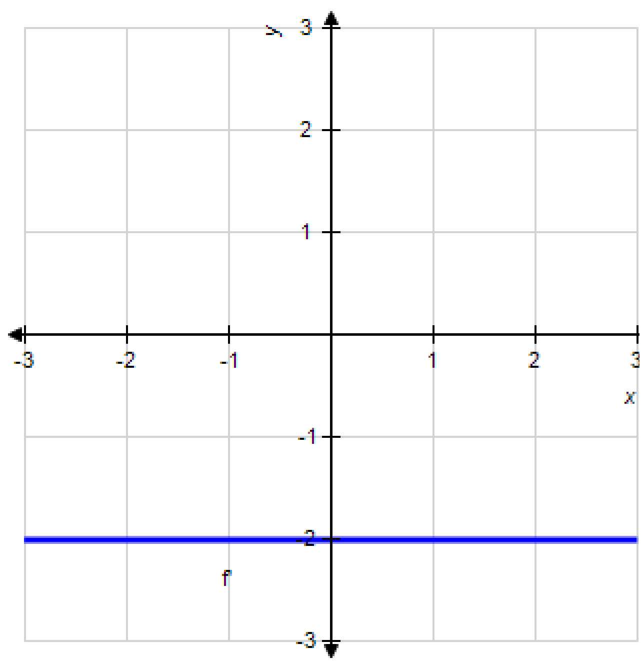


a.

b.

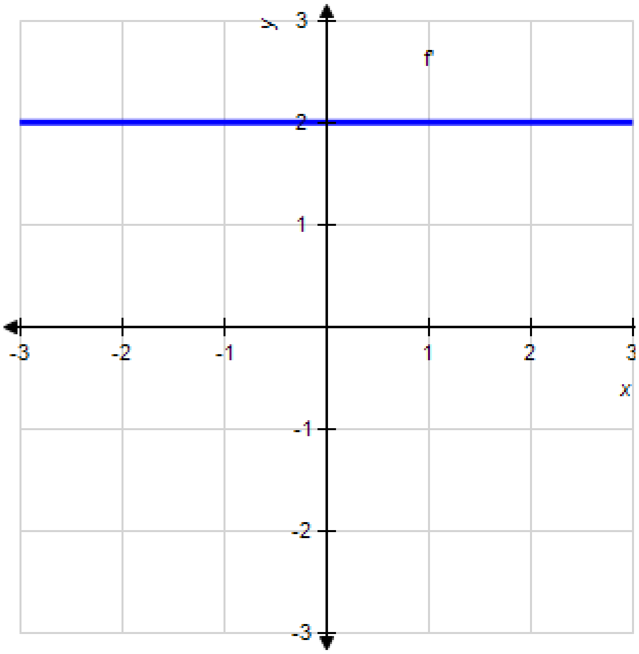


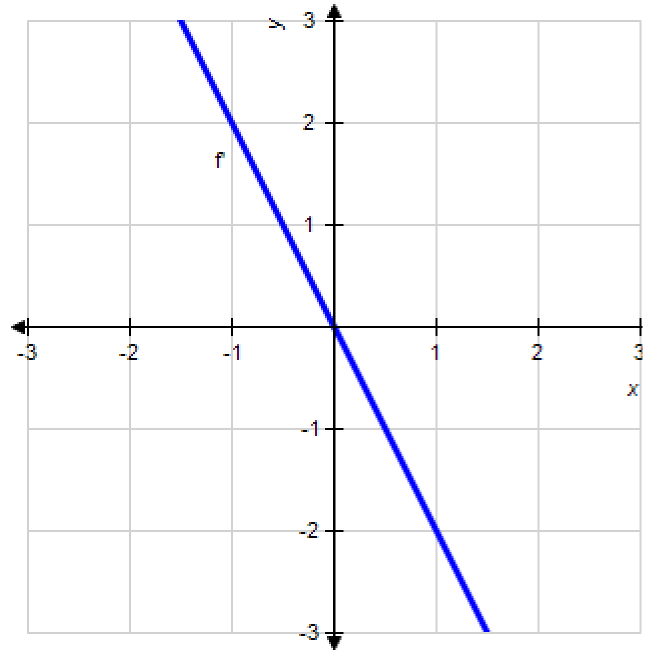
c.



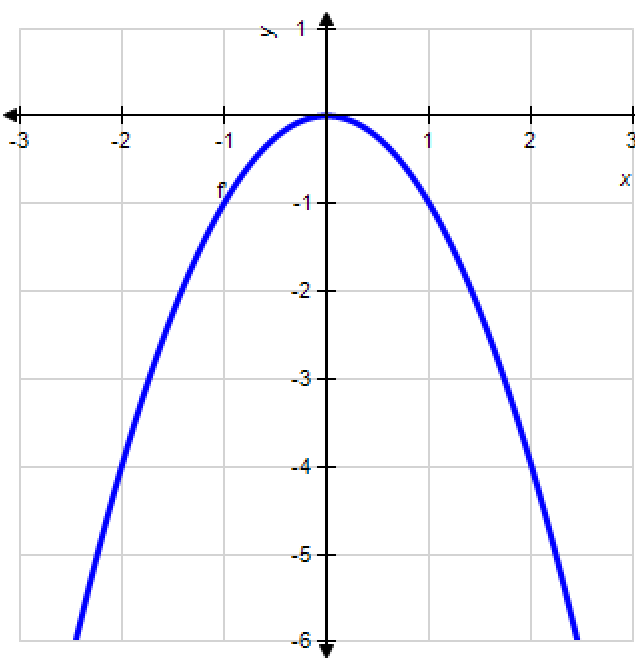
d.

Section 2.1





e.



ANSWER: a

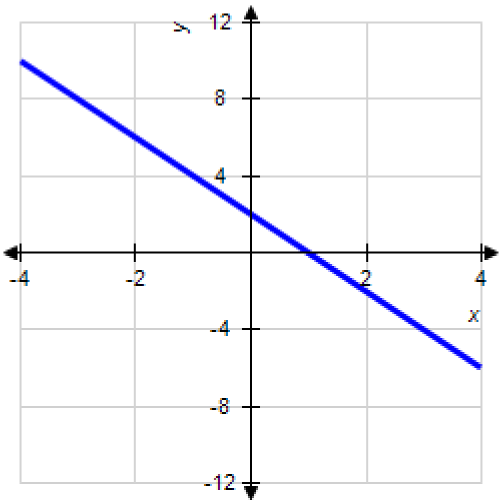
18. Identify the graph which has the following characteristics.

Section 2.1

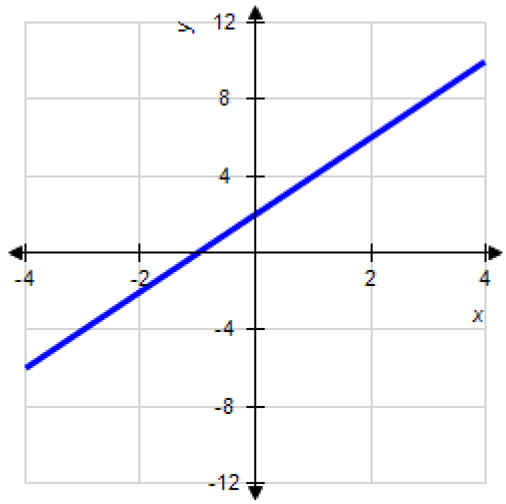
$f(0) = -2$

$f'(x) = -2, \ -\infty < x < \infty$

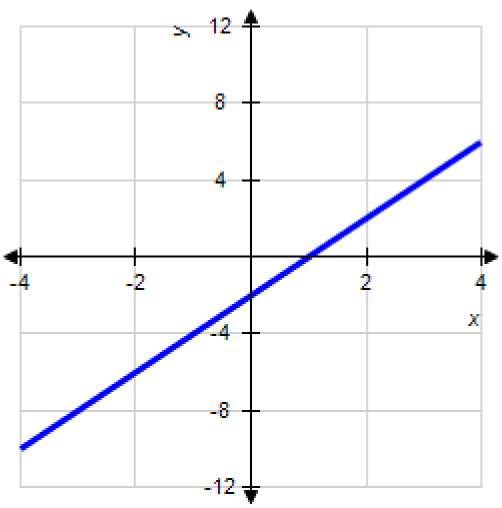
Graph 1



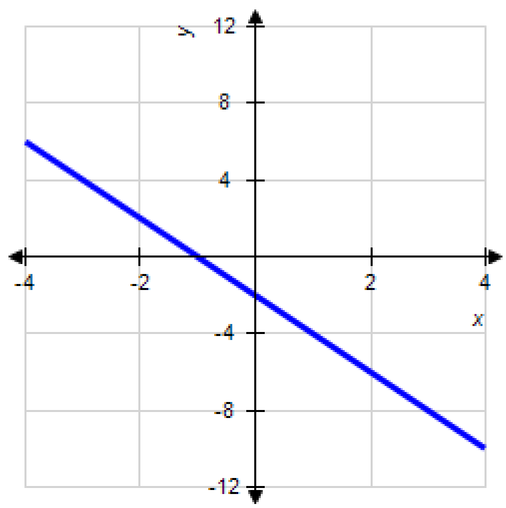
Graph 2



Graph 3



Graph 4



a. Graph 1
b. Graph 2
c. Graph 3
d. Graph 4
e. none of the above

ANSWER: d

19. Use the alternative form of the derivative to find the derivative of the function $f(x) = x^3 - 3$ at $x = 4$.

a. $f'(4) = 45$
b. $f'(4) = 768$
c. $f'(4) = 9$
d. $f'(4) = 256$
e. $f'(4) = 48$

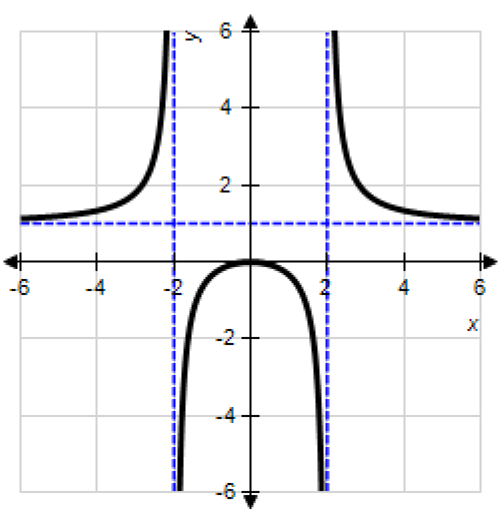
ANSWER: e

20. Use the alternative form of the derivative to find the derivative of the function $f(x) = \dfrac{5}{x^3}$ at $x = 3$.

a. $f'(3) = \dfrac{5}{27}$
b. $f'(3) = -\dfrac{5}{27}$
c. $f'(3) = \dfrac{5}{81}$
d. $f'(3) = -\dfrac{5}{3}$
e. $f'(3) = -\dfrac{20}{243}$

ANSWER: b

21. Describe the x-values at which the graph of the function $f(x) = \dfrac{x^2}{x^2 - 4}$ given below is differentiable.



Section 2.1

a. $f(x)$ is differentiable at $x = \pm 2$.
b. $f(x)$ is differentiable everywhere except at $x = \pm 2$.
c. $f(x)$ is differentiable everywhere except at $x = 0$.
d. $f(x)$ is differentiable on the interval $(-2, 2)$.
e. $f(x)$ is differentiable on the interval $(2, \infty)$.

ANSWER: b

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Section 2.2

1. Find the derivative of the function.

$f(x) = x^8$

a. $f'(x) = 8x^8$

b. $f'(x) = 7x^7$

c. $f'(x) = 8x^9$

d. $f'(x) = 7x^9$

e. $f'(x) = 8x^7$

ANSWER: e

2. Find the derivative of the function.

$f(x) = \frac{1}{x^6}$

a. $f'(x) = -\frac{7}{x^7}$

b. $f'(x) = -\frac{6}{x^5}$

c. $f'(x) = \frac{7}{x^7}$

d. $f'(x) = -\frac{6}{x^7}$

e. $f'(x) = -\frac{5}{x^7}$

ANSWER: d

3. Use the rules of differentiation to find the derivative of the function $g(x) = x^5 + 6x^2$.

a. $g'(x) = 5x^4 + 2x$

b. $g'(x) = x^4 + 6x$

c. $g'(x) = 5x^4 + 12x$

d. $g'(x) = 5x^6 + 12x^3$

e. $g'(x) = x^6 + 6x^3$

ANSWER: c

4. Find the derivative of the function $f(x) = -2x^3 - 3x^2 - 3$.

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Section 2.2

a. $f'(x) = -4x - 3x^2$

b. $f'(x) = -4x^2 - 3x$

c. $f'(x) = -2x^2 - 3x^2 - 3$

d. $f'(x) = -6x^2 - 6x - 3$

e. $f'(x) = -6x^2 - 6x$

ANSWER: e

5. Find the derivative of the function $f(x) = 6x^2 - 6\cos x$.

a. $f'(x) = 6x + 6\sin x$

b. $f'(x) = 12x + 6\sin x$

c. $f'(x) = 12x + 6\cos x$

d. $f'(x) = 12x - 6\sin x$

e. $f'(x) = 12x - 6\cos x$

ANSWER: b

6. Use the rules of differentiation to find the derivative of the function $y = 7 + 5\sin x$.

a. $y' = 7 + 5\cos x$

b. $y' = 7 + \cos(5x)$

c. $y' = 5\cos x$

d. $y' = 7\cos(5x)$

e. $y' = \cos(5x)$

ANSWER: c

7. Find the derivative of the function $f(x) = 7x^3 + 3\sin x$.

a. $f'(x) = 21x^2 - 3\cos x$

b. $f'(x) = 14x^2 + 3\cos x$

c. $f'(x) = 7x^2 + 3\cos x$

d. $f'(x) = 7x^2 - 3\cos x$

e. $f'(x) = 21x^2 + 3\cos x$

ANSWER: e

8. Find the slope of the graph of the function at the given value.

Section 2.2

$f(x) = \dfrac{3}{x^2}$ when $x = 7$

a. $f'(7) = \dfrac{6}{343}$

b. $f'(7) = \dfrac{3}{49}$

c. $f'(7) = -\dfrac{6}{7}$

d. $f'(7) = \dfrac{6}{7}$

e. $f'(7) = -\dfrac{6}{343}$

ANSWER: e

9. Find the slope of the graph of the function at the given value.

$f(x) = 4x^2 + \dfrac{8}{x^2}$ when $x = 5$

a. $f'(5) = \dfrac{5{,}016}{125}$

b. $f'(5) = -\dfrac{5{,}016}{125}$

c. $f'(5) = -\dfrac{125}{4{,}984}$

d. $f'(5) = \dfrac{4{,}984}{125}$

e. $f'(5) = \dfrac{2{,}492}{125}$

ANSWER: d

10. Find the slope of the graph of the function at the given value.

$f(x) = -3x^2 + 8x - \dfrac{6}{x^2}$ when $x = 5$

a. $f'(5) = \dfrac{2{,}738}{25}$

b. $f'(5) = -\dfrac{2{,}738}{5}$

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c. $f'(5) = -\frac{2{,}738}{25}$

d. $f'(5) = \frac{2{,}738}{125}$

e. $f'(5) = -\frac{2{,}738}{125}$

ANSWER: d

11. Find the slope of the graph of the function $f(x) = x\left(3x^3 + 5\right)$ at $x = 3$.

a. $f'(3) = 329$

b. $f'(3) = 324$

c. $f'(3) = 86$

d. $f'(3) = 339$

e. $f'(3) = 248$

ANSWER: a

12. Find the slope of the graph of the function at the given value.

$f(x) = -3x^3 - 7x^2$ at $x = 5$

a. $f'(5) = -295$

b. $f'(5) = -155$

c. $f'(5) = 65$

d. $f'(5) = -1195$

e. $f'(5) = 125$

ANSWER: a

13. Find the slope of the graph of the function $f(x) = (-4x - 5)^2$ at $x = 5$.

a. $f'(x) = -50$

b. $f'(x) = 100$

c. $f'(x) = -31{,}250$

d. $f'(x) = 120$

e. $f'(x) = 200$

ANSWER: e

14. Find the slope of the graph of the function at the given value.

Section 2.2

$f(x) = -5(-4x+9)^2$ at $x = 5$

a. $f'(5) = -440$
b. $f'(5) = -1160$
c. $f'(5) = -22$
d. $f'(5) = 110$
e. $f'(5) = 88$

ANSWER: a

15. Find the derivative of the function $f(x) = \dfrac{x^3 - 5}{x^2}$.

a. $f'(x) = 1 + \dfrac{10}{x^3}$
b. $f'(x) = 1 - \dfrac{10}{x^3}$
c. $f'(x) = 1 + \dfrac{2}{x^3}$
d. $f'(x) = 1 - \dfrac{5}{x^3}$
e. $f'(x) = 1 + \dfrac{5}{x^3}$

ANSWER: a

16. Find the derivative of the function $f(x) = \dfrac{2}{\sqrt[5]{x}} + 5\cos x$.

a. $f'(x) = \dfrac{2}{5x^{\frac{6}{5}}} - 5\sin x$
b. $f'(x) = -\dfrac{2}{5x^{\frac{6}{5}}} - 5\sin x$
c. $f'(x) = \dfrac{2}{5x^{\frac{6}{5}}} + 5\sin x$
d. $f'(x) = -\dfrac{2}{5x^{\frac{5}{6}}} - 5\sin x$

e. $f'(x) = -\dfrac{2}{5x^{\frac{5}{6}}} + 5\sin x$

ANSWER: b

17. Determine all values of *x*, (if any), at which the graph of the function has a horizontal tangent.

$y(x) = x^3 + 15x^2 + 9$

a. $x = 0$
b. $x = -10$
c. $x = 0$ and $x = -10$
d. $x = 0$ and $x = 10$
e. The graph has no horizontal tangents.

ANSWER: c

18. Determine all values of *x*, (if any), at which the graph of the function has a horizontal tangent.

$y(x) = x^4 - 108x + 8$

a. $x = 3$
b. $x = 0$ and $x = -3$
c. $x = 0$ and $x = 3$
d. $x = 0$
e. The graph has no horizontal tangents.

ANSWER: a

19. Determine all values of *x*, (if any), at which the graph of the function has a horizontal tangent.

$y(x) = \dfrac{9}{x-2}$

a. $x = 9$ and $x = -2$
b. $x = 9$
c. $x = 9$ and $x = 2$
d. $x = 2$
e. The graph has no horizontal tangents.

ANSWER: e

20. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -11t^5 + v_0 t + s_0$. A silver coin is dropped from the top of a building that is 1,360 feet tall. Determine the velocity function for the coin.

a. $v(t) = -11t^5 + 1{,}360$

b. $v(t) = -55t^4$

c. $v(t) = -55t^5 + 1{,}360$

d. $v(t) = -11t^4$

e. $v(t) = -5t^6$

ANSWER: b

21. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -12t^2 + v_0 t + s_0$. A silver coin is dropped from the top of a building that is 1,366 feet tall. Determine the average velocity of the coin over the time interval $[2, 3]$.

a. –64 ft/sec
b. 36 ft/sec
c. 60 ft/sec
d. –60 ft/sec
e. –36 ft/sec

ANSWER: d

22. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -11t^2 + v_0 t + s_0$. A silver coin is dropped from the top of a building that is 1,372 feet tall. Find the instantaneous velocity of the coin when $t = 2$.

a. –44 ft/sec
b. –31 ft/sec
c. –20 ft/sec
d. –66 ft/sec
e. –22 ft/sec

ANSWER: a

23. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -15t^2 + v_0 t + s_0$. A silver coin is dropped from the top of a building that is 1,362 feet tall. Find the time required for the coin to reach ground level. Round your answer to the three decimal places.

a. 2.307 sec
b. 9.226 sec
c. 9.529 sec
d. 2.460 sec
e. 8.989 sec

ANSWER: c

24. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -13t^2 + v_0 t + s_0$. A silver coin is dropped from the top of a building that is 1,364 feet tall. Find velocity of the coin at impact. Round your answer to the three decimal places.

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a. –276.377 ft/sec
b. –133.162 ft/sec
c. –110.797 ft/sec
d. –266.323 ft/sec
e. –247.323 ft/sec

ANSWER: d

25. A ball is thrown straight down from the top of a 200-ft building with an initial velocity of –18 ft per second. The position function is $s(t) = -16t^2 + v_0t + s_0$. What is the velocity of the ball after 4 seconds?

a. The velocity after 4 seconds is –82 ft per second.
b. The velocity after 4 seconds is –110 ft per second.
c. The velocity after 4 seconds is –146 ft per second.
d. The velocity after 4 seconds is –46 ft per second.
e. The velocity after 4 seconds is –292 ft per second.

ANSWER: c

26. A projectile is shot upwards from the surface of the earth with an initial velocity of 126 meters per second. The position function is $s(t) = -4.9t^2 + v_0t + s_0$.

What is its velocity after 8 seconds? Round your answer to one decimal place.

a. The velocity after 8 seconds is 212.8 meters per second.
b. The velocity after 8 seconds is –165.2 meters per second.
c. The velocity after 8 seconds is 47.6 meters per second.
d. The velocity after 8 seconds is 86.8 meters per second.
e. The velocity after 8 seconds is –204.4 meters per second.

ANSWER: c

27. The volume of a cube with sides of length *s* is given by $V = s^3$. Find the rate of change of volume with respect to *s* when $s = 13$ centimeters.

a. 6,591 cm^2
b. 2,197 cm^2
c. 169 cm^2
d. 507 cm^2
e. 338 cm^2

ANSWER: d

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Section 2.3

1. Find the derivative of the algebraic function $H(x) = (x^6 - 5)(x^3 + 3)$.

a. $H'(s) = 9x^8 + 18x^5 + 15x^2$

b. $H'(s) = 9x^8 + 15x^5 + 18x^2$

c. $H'(s) = 9x^8 - 18x^5 - 15x^2$

d. $H'(s) = 9x^8 + 18x^5 - 15x^2$

e. $H'(s) = 9x^8 + 15x^5 - 3x^2$

ANSWER: d

2. Use the Product Rule to differentiate $f(r) = \sqrt{r}(5 - r^5)$.

a. $f'(r) = 5r^{\frac{9}{2}} + \dfrac{5 - r^6}{2\sqrt{r}}$

b. $f'(r) = -5r^{\frac{11}{2}} - \dfrac{5 - r^5}{2\sqrt{r}}$

c. $f'(r) = 5r^{\frac{11}{2}} - \dfrac{5 - r^5}{2\sqrt{r}}$

d. $f'(r) = -5r^{\frac{9}{2}} + \dfrac{5 - r^5}{2\sqrt{r}}$

e. $f'(r) = -5r^{\frac{11}{2}} + \dfrac{5 - r^5}{2\sqrt{r}}$

ANSWER: d

3. Use the Product Rule to differentiate $f(t) = t^5 \cos t$.

a. $f'(t) = -5t^4 \sin t$

b. $f'(t) = -t^5 \cos t + 5t^4 \sin t$

c. $f'(t) = -t^5 \sin t - 5t^4 \cos t$

d. $f'(t) = -t^5 \sin t + 5t^4 \cos t$

e. $f'(t) = t^5 \sin t + 5t^4 \cos t$

ANSWER: d

4. Use the Product Rule to differentiate.

Section 2.3

$f(x)=x^{-4}\cos x$

a. $f'(x)=-x^{-4}\sin x+4x^{-5}\cos x$

b. $f'(x)=4x^{-3}\cos x-x^{-4}\sin x$

c. $f'(x)=x^{-4}\sin x-4x^{-5}\cos x$

d. $f'(x)=-x^{-4}\sin x-4x^{-5}\cos x$

e. $f'(x)=-x^{-4}\sin x+4x^{-5}\sin x$

ANSWER: d

5. Use the Product Rule to differentiate $f(v)=v^{-4}\sin v$.

a. $f'(v)=v^{-4}\cos v-4v^{3}\sin v$

b. $f'(v)=-v^{-4}\cos v+4v^{-5}\sin v$

c. $f'(v)=-v^{-4}\cos v-4v^{-3}\sin v$

d. $f'(v)=v^{-4}\cos v+4v^{-5}\sin v$

e. $f'(v)=v^{-4}\cos v-4v^{-5}\sin v$

ANSWER: e

6. Use the Quotient Rule to differentiate the function $f(v)=\dfrac{2v}{v^5+2}$.

a. $f'(v)=-\dfrac{2\left(-2+4v^5\right)}{\left(v^5+2\right)^2}$

b. $f'(v)=\dfrac{2\left(-2-4v^5\right)}{\left(v^5+2\right)^2}$

c. $f'(v)=-\dfrac{2\left(2+5v^5\right)}{\left(v^5+2\right)^2}$

d. $f'(v)=\dfrac{2\left(2+4v^5\right)}{\left(v^5+2\right)^2}$

e. $f'(v)=-\dfrac{2\left(2+6v^5\right)}{\left(v^5+2\right)^2}$

ANSWER: a

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7. Use the Quotient Rule to differentiate the function $f'(x)=\dfrac{3+x}{x^2+2}$.

a. $f'(x)=\dfrac{(2+6x-x^2)}{(x^2+2)^2}$

b. $f'(x)=\dfrac{(2-6x-x^2)}{(x^2+2)^2}$

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

d. $f'(x)=-\dfrac{(2-6x-x^2)}{(x^2+2)^2}$

e. $f'(x)=\dfrac{(2-6x+x^2)}{(x^2+2)^2}$

ANSWER: b

8. Use the Quotient Rule to differentiate the function $f(u)=\dfrac{\sin u}{u^2+10}$.

a. $f'(u)=\dfrac{(10+u^2)\cos u+2u\sin u}{(u^2+10)^2}$

b. $f'(u)=\dfrac{(10+u^2)\cos u-2u\sin u}{(u^2+10)^2}$

c. $f'(u)=\dfrac{(10+u)\cos u-2u\sin u}{(u^2+10)^2}$

d. $f'(u)=\dfrac{(10-u^2)\cos u-2u\sin u}{(u^2+10)^2}$

e. $f'(u)=\dfrac{(10+u^2)\cos u-2u\sin u}{(u^2+10)}$

ANSWER: b

9. Use the Quotient Rule to differentiate the following function $f(v)=\dfrac{6v}{v^4+4}$ and evaluate $f'(-1)$.

a. $f'(-1)=-\dfrac{6}{5}$

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b. $f'(-1) = \frac{6}{125}$

c. $f'(-1) = \frac{6}{25}$

d. $f'(-1) = \frac{6}{5}$

e. $f'(-1) = -\frac{6}{25}$

ANSWER: c

10. Find the derivative of the algebraic function $f(v) = v\left(2 - \frac{2}{v+8}\right)$.

a. $f'(v) = \frac{112 - 32v + 2v^2}{(v+8)^2}$

b. $f'(v) = \frac{112 + 32v + 2v^2}{(v+8)^2}$

c. $f'(v) = \frac{112 + 6v + 2v^2}{(v+8)^2}$

d. $f'(v) = \frac{112 - 32v - 2v^2}{(v+8)^2}$

e. $f'(v) = \frac{112 + 32v - 2v^2}{(v+8)}$

ANSWER: b

11. Find the derivative of the function $f(s) = 24s^4 + 5\sec s$.

a. $f'(s) = 96s^3 + 5\sec s \cdot \tan s$

b. $f'(s) = 4s^3 + 5\sec^2 s$

c. $f'(s) = 96s^3 + 5\tan s$

d. $f'(s) = 4s^3 + 5\sec s \cdot \tan s$

e. $f'(s) = 96s^3 - 5\sec s \cdot \tan s$

ANSWER: a

12. Find the derivative of the function.

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$f(v) = 6v\sin v + 4\cos v$

a. $f'(v) = 6v\sin v - 2\cos v$
b. $f'(v) = 6v\cos v + 2\sin v$
c. $f'(v) = 6v\sin v - 6\cos v$
d. $f'(v) = -6v\sin v + 2\cos v$
e. $f'(v) = 6v\cos v + 4\sin v$

ANSWER: b

13. Find the derivative of the trigonometric function $f(t) = t^4 \tan t$.

a. $f'(t) = t^4\sec^2 t + 4t^3\tan t$
b. $f'(t) = t^4\sec^2 t + 3t^3\tan t$
c. $f'(t) = 4t^4\tan t - t^3 \sec^2 t$
d. $f'(t) = t^3\sec^2 t - 4t^3\tan t$
e. $f'(t) = t^4\sec t + 4t^3\tan t$

ANSWER: a

14. Find the derivative of the function.

$f(x) = -4x^4\sin x + 5x^8\cos x$

a. $f'(x) = \left(-16x^8 - 5x^3\right)\sin x + \left(-4x^4 + 40x^7\right)\cos x$
b. $f'(x) = \left(-16x^3 - 5x^8\right)\sin x + \left(-4x^4 + 40x^7\right)\cos x$
c. $f'(x) = -\left(-16x^3 - 5x^8\right)\sin x + \left(-4x^4 + 40x^7\right)\cos x$
d. $f'(x) = \left(-4x^4 - 40x^7\right)\sin x + \left(-16x^3 - 5x^8\right)\cos x$
e. $f'(x) = \left(-16x^3 - 5x^8\right)\sin x - \left(-4x^4 + 40x^7\right)\cos x$

ANSWER: b

15. Find an equation of the tangent line to the graph of *f* at the given point.

$f(s) = (s-3)\left(s^2-4\right)$, at $(-2,\ 0)$

a. $y = -20s + 40$
b. $y = 20 + 40s$
c. $y = 20s + 40$

d. $y = 40s + 20$
e. $y = 20s - 40$

ANSWER: c

16. Determine all values of x, (if any), at which the graph of the function has a horizontal tangent.

$$y(x) = \frac{5x}{(x-3)^2}$$

a. $x = 3$ and $x = -5$
b. $x = -3$
c. $x = -3$ and $x = 5$
d. $x = 5$
e. The graph has no horizontal tangents.

ANSWER: b

17. The length of a rectangle is $5t + 5$ and its height is t^3, where t is time in seconds and the dimensions are in inches. Find the rate of change of the area, A, with respect to time.

a. $\frac{dA}{dt} = t^3(15 + 20t)$ square inches/second
b. $\frac{dA}{dt} = t^2(15 + 15t)$ square inches/second
c. $\frac{dA}{dt} = t^2(15 + 20t)$ square inches/second
d. $\frac{dA}{dt} = t^3(10 + 20t)$ square inches/second
e. $\frac{dA}{dt} = t^2(20t + 5)$ square inches/second

ANSWER: c

18. The radius of a right circular cylinder is $\sqrt{4t + 6}$ and its height is t^6, where t is time in seconds and the dimensions are in inches. Find the rate of change of the volume of the cylinder, V, with respect to time.

a. $\frac{dV}{dt} = \pi t^5(36 + 24t)$ cubic inches per second
b. $\frac{dV}{dt} = \pi t^5(36 + 28t)$ cubic inches per second
c. $\frac{dV}{dt} = \pi t^4(36 + 28t)$ cubic inches per second

d. $\frac{dV}{dt} = \pi t^5(6+28t)$ cubic inches per second

e. $\frac{dV}{dt} = \pi t^6(36+28t)$ cubic inches per second

ANSWER: b

19. The ordering and transportation cost C for the components used in manufacturing a product is $C = 100\left(\frac{420}{x^2} + \frac{x}{x+50}\right)$, $x \geq 1$ where C is measured in thousands of dollars and x is the order size in hundreds. Find the rate of change of C with respect to x for $x = 20$. Round your answer to two decimal places.

a. –10.48 thousand dollars per hundred
b. 11.52 thousand dollars per hundred
c. 5.27 thousand dollars per hundred
d. –9.48 thousand dollars per hundred
e. –14.63 thousand dollars per hundred

ANSWER: d

20. A population of 510 bacteria is introduced into a culture and grows in number according to the equation $P(t) = 510\left(1 + \frac{8t}{46+t^2}\right)$, where t is measured in hours. Find the rate at which the population is growing when $t = 3$. Round your answer to two decimal places.

a. 484.2 bacteria per hour
b. 83.27 bacteria per hour
c. 74.18 bacteria per hour
d. 49.9 bacteria per hour
e. 73.07 bacteria per hour

ANSWER: d

21. When satellites observe Earth, they can scan only part of Earth's surface. Some satellites have sensors that can measure the angle θ shown in the figure. Let h represent the satellite's distance from Earth's surface and let r represent Earth's radius. Find the rate at which h is changing with respect to θ when $\theta = 60°$ (Assume $r = 3{,}963$ miles.) Round your answer to the nearest unit.

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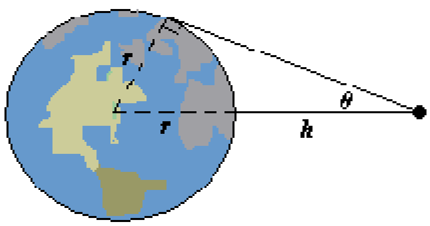

a. –2,642 mi/radian
b. –4,576 mi/radian
c. 4,576 mi/radian
d. –7,926 mi/radian
e. 2,642 mi/radian

ANSWER: a

22. Find the second derivative of the function $f(x) = 4x^{\frac{5}{3}}$.

a. $f''(x) = \frac{40}{9}x^{\frac{-2}{3}}$

b. $f''(x) = \frac{5}{9}x^{\frac{-1}{3}}$

c. $f''(x) = \frac{40}{9}x^{\frac{-1}{3}}$

d. $f''(x) = \frac{-40}{9}x^{\frac{-1}{3}}$

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

ANSWER: c

23. Find the second derivative of the function $f(t) = \frac{3t^2 + 6t - 3}{t}$.

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a. $f''(s) = -\frac{6}{t^3}$

b. $f''(s) = \frac{6}{t^3}$

c. $f''(s) = -\frac{t+6}{t^3}$

d. $f''(s) = \frac{3}{t^3}$

e. $f''(s) = -\frac{6}{t^2}$

ANSWER: a

24. Find the second derivative of the function $f(t) = t^5 \sec t$.

a. $f''(t) = t^3 \sec t\left(20 + t\sec^2 t + 10t\tan t + t^2\tan^2 t\right)$

b. $f''(t) = t^3 \sec t\left(20 + t^2\sec^2 t + 10t\tan t + t^2\tan^2 t\right)$

c. $f''(t) = t^3 \sec t\left(20 + t^2\sec^2 t + 5t\tan t + t^2\tan^2 t\right)$

d. $f''(t) = t^3 \sec t\left(20 + t^2\sec^2 t + 10t\tan t + t^2\tan t\right)$

e. $f''(t) = t^3 \sec t\left(20 + t^2\sec^2 t + 10t\tan t + t\tan^2 t\right)$

ANSWER: b

25. Given the derivative below find the requested higher-order derivative.

$f''(x) = 8x^{\frac{7}{5}}$, $f^{(IV)}(x)$

a. $f^{(IV)}(x) = -\frac{56}{5}x^{\frac{2}{5}}$

b. $f^{(IV)}(x) = \frac{112}{25}x^{\frac{2}{5}}$

c. $f^{(IV)}(x) = \frac{112}{25}x^{\frac{-3}{5}}$

d. $f^{(IV)}(x) = \frac{56}{5}x^{\frac{2}{5}}$

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e. $f^{(IV)}(x) = -\frac{112}{25}x^{\frac{-3}{5}}$

ANSWER: c

26. Suppose that an automobile's velocity starting from rest is $v(t) = \frac{280t}{5t+15}$ where v is measured in feet per second. Find the acceleration at 5 seconds. Round your answer to one decimal place.

a. 3.3 ft/sec^2
b. 2.6 ft/sec^2
c. 0.9 ft/sec^2
d. 0.7 ft/sec^2
e. 13.1 ft/sec^2

ANSWER: b

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Section 2.4

1. Find the derivative of the algebraic function $f(v)=\left(v^3+4\right)^4$.

a. $f'(v)=4v^2\left(v^3+4\right)^3$

b. $f'(v)=3v^2\left(v^3+4\right)^3$

c. $f'(v)=12v^2\left(v^3+4\right)^3$

d. $f'(v)=12v^4\left(v^3+4\right)^3$

e. $f'(v)=12v^3\left(v^3+4\right)^3$

ANSWER: c

2. Find the derivative of the function.

$f(t)=\left(1+7t^5\right)^7$

a. $f'(t)=245t^4\left(1+7t^4\right)^6$

b. $f'(t)=245t^4\left(1+7t^5\right)^6$

c. $f'(t)=7t^4\left(1+7t^5\right)^6$

d. $f'(t)=245t^6\left(1+7t^5\right)^6$

e. $f'(t)=245t^7\left(1+7t^5\right)^6$

ANSWER: b

3. Find the derivative of the function.

$f(t)=(4+3t)^{\frac{4}{7}}$

a. $f'(t)=\frac{12}{7}(4+3t)^{\frac{-3}{7}}$

b. $f'(t)=\frac{3}{7}(4+3t)^{\frac{-3}{7}}$

c. $f'(t)=\frac{4}{7}(4+3t)^{\frac{-3}{7}}$

d. $f'(t) = \frac{12}{7}(4+3t)^{\frac{-3}{4}}$

e. $f'(t) = 3(4+3t)^{\frac{-3}{7}}$

ANSWER: a

4. Find the derivative of the function.

$f(x) = x^6(2+7x)^7$

a. $f'(x) = x^6(2+7x)^5(12+91x)$

b. $f'(x) = x^5(2+7x)^6(12+91x)$

c. $f'(x) = 7x^6(2+7x)^6(12+91x)$

d. $f'(x) = x^5(2+7x)^7(12+91x)$

e. $f'(x) = x^5(2+7x)^6(12+7x)$

ANSWER: b

5. Find the derivative of the function.

$f(x) = x^6\sqrt{5-7x}$

a. $f'(x) = \frac{x^5(5-91x)}{2\sqrt{5-7x}}$

b. $f'(x) = \frac{x^5(60-7x)}{2\sqrt{5-7x}}$

c. $f'(x) = \frac{x^5(60+91x)}{2\sqrt{5-7x}}$

d. $f'(x) = \frac{x^5(5+7x)}{2\sqrt{5-7x}}$

e. $f'(x) = \frac{x^5(60-91x)}{2\sqrt{5-7x}}$

ANSWER: e

6. Find the derivative of the function.

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$g(x)=\left(\frac{x+3}{x^2+5}\right)^3$

a. $g'(x)=\frac{3(5-6x+x^2)}{(5+x^2)}\left(\frac{3+x}{5+x^2}\right)^3$

b. $g'(x)=\frac{3(5-6x+x^2)(3+x)^2}{(5+x^2)^4}$

c. $g'(x)=\frac{3(5+6x-x^2)(3+x)^2}{(5+x^2)^4}$

d. $g'(x)=\frac{3(5-6x-x^2)(3+x)^4}{(5+x^2)^2}$

e. $g'(x)=\frac{3(5-6x-x^2)(3+x)^2}{(5+x^2)^4}$

ANSWER: e

7. Find the derivative of the function $y=8\cos(2x)$.

a. $y'=-2\sin(2x)$
b. $y'=-8\sin(2x)$
c. $y'=-16\sin(2x)$
d. $y'=16\cos(2x)$
e. $y'=-16\cos(2x)$

ANSWER: c

8. Find the derivative of the function $y=8\sin(2x)$.

a. $y'=16\sin(2x)$
b. $y'=16\cos(2x)$
c. $y'=-8\sin(2x)$
d. $y'=-16\cos(2x)$
e. $y'=8\cos(2x)$

ANSWER: b

9. Find the derivative of the function.

$y=\cos(4x^4+2)$

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a. $y' = 16x^4 \cos\left(4x^4+2\right)$

b. $y' = 16 \sin\left(4x^4+2\right)$

c. $y' = -16x^3 \sin\left(4x^4+2\right)$

d. $y' = -16 \sin\left(4x^4+2\right)$

e. $y' = -4 \sin\left(4x^4+2\right)$

ANSWER: c

10. Find the derivative of the function.

$f(\theta) = \frac{3}{7}\sin^2 3\theta$

a. $f'(\theta) = -\frac{18 \sin 3\theta \cos 3\theta}{7}$

b. $f'(\theta) = \frac{18 \cos 3\theta}{7}$

c. $f'(\theta) = \frac{18 \sin 3\theta \cos 3\theta}{7}$

d. $f'(\theta) = -\frac{3 \sin 3\theta \cos 3\theta}{7}$

e. $f'(\theta) = \frac{18 \sin 3\theta}{7}$

ANSWER: c

11. Find the derivative of the function.

$y = \frac{4}{5}\sec^2 x$

a. $y' = -\frac{8}{5}\sec^2 x \tan x$

b. $y' = \frac{8}{5}\sec^2 x \tan^2 x$

c. $y' = \frac{8}{5}\sec x \tan x$

d. $y' = \frac{8}{5}\sec^2 x \tan x$

e. $y' = \frac{4}{5}\sec^2 x \tan x$

ANSWER: d

12. Find the derivative of the function.

$f(t) = 2\sec^2(5\pi t - 1)$

a. $f'(t) = 10\pi\sec^2(5\pi t - 1)\tan(5\pi t - 1)$

b. $f'(t) = 20\sec^2(5\pi t - 1)\tan(5\pi t - 1)$

c. $f'(t) = 20\pi\sec^2(5\pi t - 1)\tan(5\pi t - 1)$

d. $f'(t) = 20\pi\sec^2(5\pi t - 1)\tan(1 - 5\pi t)$

e. $f'(t) = 5\pi\sec^2(5\pi t - 1)\tan(5\pi t - 1)$

ANSWER: c

13. Evaluate the derivative of the function $y = \sqrt[2]{3x^4 + 3x}$ at the point $x = 3$.

a. $y'(3) = \frac{327}{(252)^{\frac{1}{2}}}$

b. $y'(3) = \frac{327}{4(252)^{\frac{1}{2}}}$

c. $y'(3) = \frac{327}{2(252)^{\frac{1}{2}}}$

d. $y'(3) = \frac{327}{22(252)^{\frac{3}{4}}}$

e. $y'(3) = \frac{327}{4(252)^{\frac{5}{4}}}$

ANSWER: c

14. Evaluate the derivative of the function at the given point.

$f(t) = \frac{2}{t-1},\ \left(5, \frac{1}{2}\right)$

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a. $f'(5) = \frac{1}{8}$

b. $f'(5) = -\frac{1}{8}$

c. $f'(5) = -\frac{1}{32}$

d. $f'(5) = -\frac{1}{2}$

e. $f'(5) = \frac{1}{2}$

ANSWER: b

15. Evaluate the derivative of the function $f(t) = \frac{8t+3}{5t-1}$ at the point $\left(5, \frac{43}{24}\right)$.

a. $f'(5) = -\frac{23}{24}$

b. $f'(5) = \frac{23}{576}$

c. $f'(5) = \frac{23}{24}$

d. $f'(5) = -\frac{23}{26}$

e. $f'(5) = -\frac{23}{576}$

ANSWER: e

16. Evaluate the derivative of the function $f(t) = \frac{9t^2+3}{5t-1}$ at the point $\left(2, \frac{13}{3}\right)$.

a. $f'(2) = \frac{43}{243}$

b. $f'(2) = -\frac{43}{27}$

c. $f'(2) = \frac{43}{3}$

d. $f'(2) = -\frac{43}{3}$

e. $f'(2) = \frac{43}{27}$

ANSWER: e

17. Find an equation to the tangent line for the graph of *f* at the given point.

$f(x) = \left(2x^5 + 8\right)^2$, $(1, 100)$

a. $y = 200x + 100$
b. $y = 100x + 100$
c. $y = 100x - 100$
d. $y = 200x - 100$
e. $y = -200x - 100$

ANSWER: d

18. Find an equation to the tangent line to the graph of the function $f(x) = \tan^6 x$ at the point $\left(\frac{2\pi}{5}, 849.853\right)$.

The coefficients below are given to two decimal places.

a. $y = 17{,}350.27x - 20{,}953.14$
b. $y = -17{,}350.27x - 20{,}953.14$
c. $y = 5{,}361.53x - 20{,}953.14$
d. $y = 17{,}350.27x + 20{,}953.14$
e. $y = 5{,}361.53x + 20{,}953.14$

ANSWER: a

19. Find the second derivative of the function.

$f(x) = \left(3x^5 + 6\right)^6$

a. $f'' = 90x^3(6 + 3x)^4\left(24 + 90x^5\right)$

b. $f'' = 90x^3\left(6 + 3x^5\right)^4\left(24 + 87x^5\right)$

c. $f'' = 90x^3\left(6 + 3x^4\right)^4\left(24 + 87x^5\right)$

d. $f'' = 90x^3\left(6 + 3x^5\right)^4\left(24 + 90x^5\right)$

e. $f'' = 90x^3\left(6 + 3x^5\right)^4\left(24 - 87x^5\right)$

ANSWER: b

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20. Find the second derivative of the function $f(x)=\sin(2x^4)$.

a. $f''(x)=8x^2\cos(2x^4)+8x^6\sin(2x^4)$
b. $f''(x)=8x^2\cos(2x^4)-64x^6\sin(2x^4)$
c. $f''(x)=32x^2\cos(2x^4)-64x^6\sin(2x^4)$
d. $f''(x)=24x^2\cos(2x^4)+64x^6\sin(2x^4)$
e. $f''(x)=24x^2\cos(2x^4)-64x^6\sin(2x^4)$

ANSWER: e

21. The displacement from equilibrium of an object in harmonic motion on the end of a spring is $y=\frac{1}{4}\cos 24t-\frac{1}{6}\sin 18t$, where y is measured in feet and t is the time in seconds. Determine the position of the object when $t=\frac{\pi}{10}$. Round your answer to two decimal places.

a. 4.76 feet
b. 0.90 feet
c. 9.70 feet
d. 0.53 feet
e. 0.18 feet

ANSWER: e

22. The displacement from equilibrium of an object in harmonic motion on the end of a spring is $y=\frac{1}{5}\cos 20t-\frac{1}{2}\sin 6t$, where y is measured in feet and t is the time in seconds. Determine the velocity of the object when $t=\frac{\pi}{6}$. Round your answer to two decimal places.

a. 8.46 ft/sec
b. 3.74 ft/sec
c. 6.46 ft/sec
d. 2.46 ft/sec
e. 3.87 ft/sec

ANSWER: c

23. Suppose a 15-centimeter pendulum moves according to the equation $\theta=0.9\cos 8t$, where θ is the angular displacement from the vertical in radians and t is the time in seconds. Determine the rate of change of θ when $t=13$ seconds. Round your answer to four decimal places.

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a. 2.3157 radians per second
b. 3.4308 radians per second
c. 0.2895 radians per second
d. 3.0252 radians per second
e. 2.573 radians per second

ANSWER: a

24. A buoy oscillates in simple harmonic motion $y = A\cos\omega t$ as waves move past it. The buoy moves a total of 2.5 feet (vertically) between its low point and its high point. It returns to its high point every 8 seconds. Write an equation describing the motion of the buoy if it is at its high point at $t = 0$.

a. $y = 2.5\cos\frac{\pi}{4}t$
b. $y = 1.25\cos 4\pi t$
c. $y = 1.25\cos\frac{\pi}{8}t$
d. $y = 1.25\cos\frac{\pi}{4}t$
e. $y = 2.5\cos 8\pi t$

ANSWER: d

25. A buoy oscillates in simple harmonic motion $y = A\cos\omega t$ as waves move past it. The buoy moves a total of 16.5 feet (vertically) between its low point and its high point. It returns to its high point every 10 seconds. Determine the velocity of the buoy as a function of *t*.

a. $v = -8.25\pi\sin\frac{\pi}{10}t$
b. $v = 8.25\pi\sin\frac{\pi}{5}t$
c. $v = -1.65\pi\sin\frac{\pi}{5}t$
d. $v = -1.65\pi\sin\frac{\pi}{10}t$
e. $v = 1.65\pi\sin\frac{\pi}{5}t$

ANSWER: c

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Section 2.5

1. Find $\frac{dy}{dx}$ by implicit differentiation.

$x^2+y^2=25$

a. $\frac{dy}{dx}=\frac{x}{y}$

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

c. $\frac{dy}{dx}=\frac{y}{x}$

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

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

ANSWER: b

2. Find $\frac{dy}{dx}$ by implicit differentiation.

$x^{\frac{6}{7}}+y^{\frac{8}{5}}=25$

a. $\frac{dy}{dx}=-\frac{28x^{\frac{-1}{7}}}{15y^{\frac{3}{5}}}$

b. $\frac{dy}{dx}=-\frac{45x^{\frac{-1}{7}}}{28y^{\frac{3}{5}}}$

c. $\frac{dy}{dx}=-\frac{15x^{\frac{-1}{7}}}{56y^{\frac{3}{5}}}$

d. $\frac{dy}{dx}=\frac{15x^{\frac{-1}{7}}}{28y^{\frac{3}{5}}}$

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e. $\dfrac{dy}{dx} = -\dfrac{15x^{\frac{-1}{7}}}{28y^{\frac{3}{5}}}$

ANSWER: e

3. Find $\dfrac{dy}{dx}$ by implicit differentiation.

$x^2 + 2x + 11xy - y^2 = 16$

a. $\dfrac{dy}{dx} = \dfrac{2x - 2 + 11y}{2y - 11x}$

b. $\dfrac{dy}{dx} = \dfrac{2x + 2 + 11y}{2x - 11y}$

c. $\dfrac{dy}{dx} = \dfrac{x + 2 + 11y}{y - 11x}$

d. $\dfrac{dy}{dx} = \dfrac{2x + 2 + 11y}{2y - 11x}$

e. $\dfrac{dy}{dx} = \dfrac{2x + 2 - 11y}{2y - 11x}$

ANSWER: d

4. Find $\dfrac{dy}{dx}$ by implicit differentiation given that $5xy = 4$.

a. $\dfrac{dy}{dx} = -\dfrac{4y}{x}$

b. $\dfrac{dy}{dx} = -4xy$

c. $\dfrac{dy}{dx} = -xy$

d. $\dfrac{dy}{dx} = 4xy$

e. $\dfrac{dy}{dx} = -\dfrac{y}{x}$

ANSWER: e

5. Find $\dfrac{dy}{dx}$ by implicit differentiation.

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$x^3 + 7x + 3xy - y^5 = 25$

a. $\frac{dy}{dx} = -\frac{3x^2 + 7 + 3y}{5y^4 - 3x}$

b. $\frac{dy}{dx} = \frac{3x^2 + 7 - 3y}{5y^4 - 3x}$

c. $\frac{dy}{dx} = \frac{3x^2 + 7 + 3y}{4y^4 - 3x}$

d. $\frac{dy}{dx} = \frac{3x^2 + 7 + 3y}{5y^4 - 3x}$

e. $\frac{dy}{dx} = \frac{2x^2 + 7 + 3y}{5y^4 - 3x}$

ANSWER: d

6. Find $\frac{dy}{dx}$ by implicit differentiation.

$x^3 + 9x + x^9y - y^7 = 4$

a. $\frac{dy}{dx} = \frac{3x^2 + 9 + 9x^8y}{7y^6 - x^9}$

b. $\frac{dy}{dx} = \frac{3x^2 + 9 + 9y}{6y^6 - 9x}$

c. $\frac{dy}{dx} = \frac{3x^2 + 9 + 9x^8y}{6y^6 - x^9}$

d. $\frac{dy}{dx} = \frac{3x^2 + 9 + x^9y}{7y^6 - x^9}$

e. $\frac{dy}{dx} = \frac{3x^2 - 9 + 9x^8y}{7y^6 - x^9}$

ANSWER: a

7. Find $\frac{dy}{dx}$ by implicit differentiation.

$\sin x + 2\cos(6y) = 4$

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a. $\frac{dy}{dx} = \frac{\cos x}{12\cos(6y)}$

b. $\frac{dy}{dx} = \frac{\cos x}{12\sin(6y)}$

c. $\frac{dy}{dx} = \frac{\cos x}{6\sin(6y)}$

d. $\frac{dy}{dx} = \frac{\cos x}{12\sin y}$

e. $\frac{dy}{dx} = -\frac{\cos x}{12\sin(6y)}$

ANSWER: b

8. Evaluate $\frac{dy}{dx}$ for the equation $4xy = 20$ at the given point $(-5, -1)$. Round your answer to two decimal places.

a. $\frac{dy}{dx} = 4.00$

b. $\frac{dy}{dx} = 100.00$

c. $\frac{dy}{dx} = -0.20$

d. $\frac{dy}{dx} = -100.00$

e. $\frac{dy}{dx} = -5.00$

ANSWER: c

9. Find $\frac{dy}{dx}$ by implicit differentiation given that $x^{\frac{7}{8}} + y^{\frac{7}{8}} = 4$.

a. $\frac{dy}{dx} = -\sqrt[8]{xy}$

b. $\frac{dy}{dx} = \sqrt[8]{\frac{y}{x}}$

c. $\frac{dy}{dx} = -\sqrt[8]{\frac{y}{x}}$

d. $\dfrac{dy}{dx} = \sqrt[8]{xy}$

e. $\dfrac{dy}{dx} = -\sqrt[8]{\dfrac{x}{y}}$

ANSWER: c

10. Evaluate $\dfrac{dy}{dx}$ for the equation $x^{\frac{2}{3}} + y^{\frac{2}{3}} = 5$ at the given point $(8, 1)$. Round your answer to two decimal places.

a. $\dfrac{dy}{dx} = 4.00$

b. $\dfrac{dy}{dx} = 2.00$

c. $\dfrac{dy}{dx} = -0.50$

d. $\dfrac{dy}{dx} = 0.50$

e. $\dfrac{dy}{dx} = -0.25$

ANSWER: c

11. Find $\dfrac{dy}{dx}$ by implicit differentiation given that $\tan(11x + y) = 11x$. Use the original equation to simplify your answer.

a. $\dfrac{dy}{dx} = \dfrac{1{,}331x}{x^2 + 1}$

b. $\dfrac{dy}{dx} = -\dfrac{11x^2}{121x^2 - 1}$

c. $\dfrac{dy}{dx} = \dfrac{11x^2}{121x^2 + 1}$

d. $\dfrac{dy}{dx} = -\dfrac{1{,}331x^2}{121x^2 + 1}$

e. $\dfrac{dy}{dx} = \dfrac{11x^2}{x^2 - 1}$

ANSWER: d

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12. Evaluate $\frac{dy}{dx}$ for the equation $\tan(13x + 6y) = 6x$ at the given point $(0, 0)$. Round your answer to two decimal places.

a. $\frac{dy}{dx} = 2.33$

b. $\frac{dy}{dx} = -1.83$

c. $\frac{dy}{dx} = -12.00$

d. $\frac{dy}{dx} = -1.17$

e. $\frac{dy}{dx} = 2.50$

ANSWER: d

13. Find the slope of the tangent line $(10 - x)y^2 = x^3$ at the given point $(5, 5)$. Round your answer to two decimal places.

a. 0.67
b. 2.00
c. 1.00
d. 1.67
e. 3.00

ANSWER: b

14. Find an equation of the tangent line to the graph of the function $(y - 8)^2 = 10(x - 6)$ at the point $(9.60, 2.00)$. The coefficients below are given to two decimal places.

a. $y = -0.83x + 10.00$
b. $y = 4.17x + 38.00$
c. $y = 4.17x - 38.00$
d. $y = -0.83x + 38.00$
e. $y = 0.83x + 10.00$

ANSWER: a

15. Find an equation of the tangent line to the graph of the function given below at the given point.

$7x^2 - 10xy + 3y^2 - 39 = 0$, $(1, -2)$

(The coefficients below are given to two decimal places.)

a. $y = 6.55x + 8.55$

b. $y = 1.55x + 8.55$
c. $y = 1.55x - 3.55$
d. $y = -1.55x - 3.55$
e. $y = 6.55x - 8.55$

ANSWER: c

16. Use implicit differentiation to find an equation of the tangent line to the ellipse $\frac{x^2}{2} + \frac{y^2}{242} = 1$ at $(1, 11)$.

a. $y = -7x + 15$
b. $y = -2x + 13$
c. $y = -6x + 13$
d. $y = -8x + 15$
e. $y = -12x + 13$

ANSWER: b

17. Find $\frac{d^2y}{dx^2}$ in terms of x and y given that $x^2 + 7y^2 = 8$. Use the original equation to simplify your answer.

a. $y'' = -\frac{8}{49y^3}$
b. $y'' = -8y^3$
c. $y'' = -49y^3$
d. $y'' = -343y^3$
e. $y'' = -\frac{8}{343y^3}$

ANSWER: a

18. Find $\frac{d^2y}{dx^2}$ in terms of x and y.

$x^2 + y^2 = 3$

a. $\frac{d^2y}{dx^2} = \left(-\frac{x}{y}\right)^2$
b. $\frac{d^2y}{dx^2} = -\frac{3}{y^2}$

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c. $\frac{d^2y}{dx^2} = \frac{\frac{x^2}{y} + y}{y^2}$

d. $\frac{d^2y}{dx^2} = \left(-\frac{y}{x}\right)^2$

e. $\frac{d^2y}{dx^2} = -\frac{\frac{x^2}{y} + y}{y^2}$

ANSWER: e

19. Find $\frac{d^2y}{dx^2}$ in terms of x and y given that $-8xy = x - 8y$.

a. $\frac{d^2y}{dx^2} = 0$

b. $\frac{d^2y}{dx^2} = -8y^3$

c. $\frac{d^2y}{dx^2} = -8y^2$

d. $\frac{d^2y}{dx^2} = y^2$

e. $\frac{d^2y}{dx^2} = -y^3$

ANSWER: a

20. Find $\frac{d^2y}{dx^2}$ in terms of x and y.

$6 - 6xy = 5x - 5y$

a. $\frac{d^2y}{dx^2} = \frac{12(6y-5)}{(5-6x)^2}$

b. $\frac{d^2y}{dx^2} = \frac{12(6+5y)}{(5+6x)^2}$

c. $\frac{d^2y}{dx^2} = \frac{-732}{(5+6x)^3}$

d. $\frac{d^2y}{dx^2} = \frac{12(6y+5)}{(5-6x)^2}$

e. $\frac{d^2y}{dx^2} = \frac{12(6y+5)}{(5+6x)^2}$

ANSWER: d

21. Find the points at which the graph of the equation has a vertical or horizontal tangent line.

$3x^2 + 7y^2 + 6x + 42y + 3 = 0$

a. There is a vertical tangent at $y = -3$ but no horizontal tangents.
b. There is a horizontal tangent at $x = -1$ and a vertical tangent at $y = -3$.
c. There is a horizontal tangent at $x = -1$ but no vertical tangents.
d. There is a horizontal tangent at $x = -5$ and a vertical tangent at $y = -1$.
e. There are no horizontal or vertical tangent lines.

ANSWER: b

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Section 2.6

1. Assume that x and y are both differentiable functions of t . Find $\frac{dy}{dt}$ when $x = 16$ and $\frac{dx}{dt} = 9$ for the equation $y = \sqrt{x}$.

a. $\frac{dy}{dt} = \frac{9}{8}$

b. $\frac{dy}{dt} = 8$

c. $\frac{dy}{dt} = \frac{8}{9}$

d. $\frac{dy}{dt} = -\frac{9}{8}$

e. $\frac{dy}{dt} = -8$

ANSWER: a

2. Assume that x and y are both differentiable functions of t. Find $\frac{dx}{dt}$ when $x = 11$ and $\frac{dy}{dt} = -4$ for the equation $xy = 99$.

a. $\frac{dx}{dt} = -396$

b. $\frac{dx}{dt} = 44$

c. $\frac{dx}{dt} = -\frac{44}{9}$

d. $\frac{dx}{dt} = \frac{44}{9}$

e. $\frac{dx}{dt} = -44$

ANSWER: d

3. A point is moving along the graph of the function $y = \frac{1}{6x^2 + 4}$ such that $\frac{dx}{dt} = 4$ centimeters per second. Find $\frac{dy}{dt}$ when $x = 3$.

a. $\frac{dy}{dt} = -\frac{72}{29}$

b. $\frac{dy}{dt} = \frac{36}{841}$

c. $\frac{dy}{dt} = \frac{9}{841}$

d. $\frac{dy}{dt} = -\frac{9}{841}$

e. $\frac{dy}{dt} = -\frac{36}{841}$

ANSWER: e

4. A point is moving along the graph of the function $y = \sin(2x)$ such that $\frac{dx}{dt} = 9$ centimeters per second. Find $\frac{dy}{dt}$ when $x = \frac{\pi}{7}$.

a. $\frac{dy}{dt} = 2\cos\left(\frac{9\pi}{7}\right)$

b. $\frac{dy}{dt} = 18\cos\left(\frac{2\pi}{7}\right)$

c. $\frac{dy}{dt} = 2\cos\left(\frac{2\pi}{7}\right)$

d. $\frac{dy}{dt} = 18\cos\left(\frac{9\pi}{7}\right)$

e. $\frac{dy}{dt} = 18\cos\left(\frac{18\pi}{7}\right)$

ANSWER: b

5. The radius, *r,* of a circle is decreasing at a rate of 4 centimeters per minute.

Find the rate of change of area, *A*, when the radius is 4.

a. $\frac{dA}{dt} = -128\pi$ cm^2/min

b. $\frac{dA}{dt} = 128\pi$ cm^2/min

c. $\frac{dA}{dt} = -32\pi$ cm^2/min

d. $\frac{dA}{dt} = 32\pi$ cm^2/min

e. $\frac{dA}{dt} = -16\pi$ cm^2/min

ANSWER: c

6. The radius *r* of a sphere is increasing at a rate of 8 inches per minute. Find the rate of change of the volume when $r = 6$ inches.

a. $\frac{dV}{dt} = 1{,}440\pi$ in^3/min

b. $\frac{dV}{dt} = 576\pi$ in^3/min

c. $\frac{dV}{dt} = 1{,}152\pi$ in^3/min

d. $\frac{dV}{dt} = \frac{1}{576\pi}$ in^3/min

e. $\frac{dV}{dt} = \frac{1}{1{,}152\pi}$ in^3/min

ANSWER: c

7. A spherical balloon is inflated with gas at the rate of 300 cubic centimeters per minute. How fast is the radius of the balloon increasing at the instant the radius is 70 centimeters?

a. $\frac{dr}{dt} = \frac{3}{98\pi}$ cm/min

b. $\frac{dr}{dt} = \frac{1}{98\pi}$ cm/min

c. $\frac{dr}{dt} = \frac{3}{196\pi}$ cm/min

d. $\frac{dr}{dt} = 98\pi$ cm/min

e. $\frac{dr}{dt} = 3\pi$

ANSWER: c

8. All edges of a cube are expanding at a rate of 9 centimeters per second. How fast is the volume changing when each edge is 7 centimeters?

a. 1,701 cm^3/sec

b. 882 cm^3/sec

c. 441 cm^3/sec

d. 1,323 cm^3/sec

e. 567 cm^3/sec

ANSWER: d

9. A conical tank (with vertex down) is 14 feet across the top and 20 feet deep. If water is flowing into the tank at a rate of 16 cubic feet per minute, find the rate of change of the depth of the water when the water is 10 feet deep.

a. $\frac{8}{49\pi}$ ft/min

b. $\frac{16}{245\pi}$ ft/min

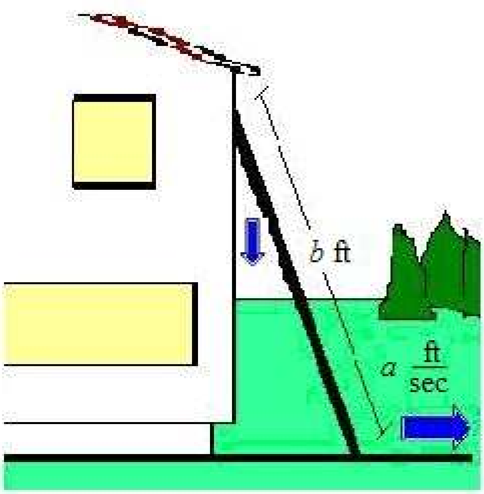
c. $\frac{160}{49\pi}$ ft/min

d. $\frac{64}{49\pi}$ ft/min

e. $\frac{49}{16\pi}$ ft/min

ANSWER: d

10. A ladder 20 feet long is leaning against the wall of a house (see the figure below). The base of the ladder is pulled away from the wall at a rate of 2 feet per second. How fast is the top of the ladder moving down the wall when its base is 14 feet from the wall? Round your answer to two decimal places.



$a = 2$, $b = 20$

a. 6.00 ft/sec

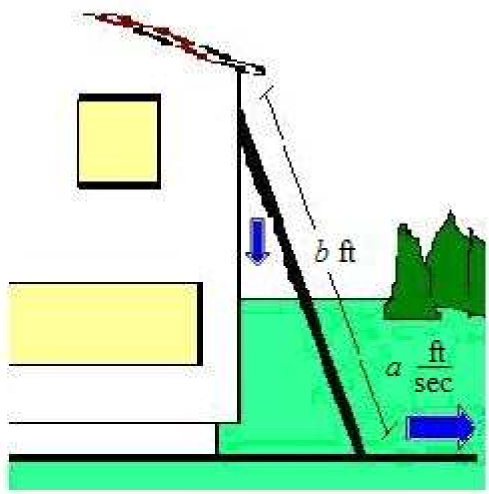
b. –5.33 ft/sec

c. –1.96 ft/sec

d. 5.33 ft/sec
e. –5.00 ft/sec

ANSWER: c

11. A ladder 25 feet long is leaning against the wall of a house (see the figure below). The base of the ladder is pulled away from the wall at a rate of 2 feet per second. Consider the triangle formed by the side of the house, the ladder, and the ground. Find the rate at which the area of the triangle is changed when the base of the ladder is 11 feet from the wall. Round your answer to two decimal places.



$a = 2$, $b = 25$

a. 16.67 ft^2/sec
b. 119.10 ft^2/sec
c. 66.34 ft^2/sec
d. 17.06 ft^2/sec
e. 40.13 ft^2/sec

ANSWER: d

12. A ladder 25 feet long is leaning against the wall of a house (see the figure below). The base of the ladder is pulled away from the wall at a rate of 2 feet per second. Find the rate at which the angle between the ladder and the wall of the house is changing when the base of the ladder is 10 feet from the wall. Round your answer to three decimal places.

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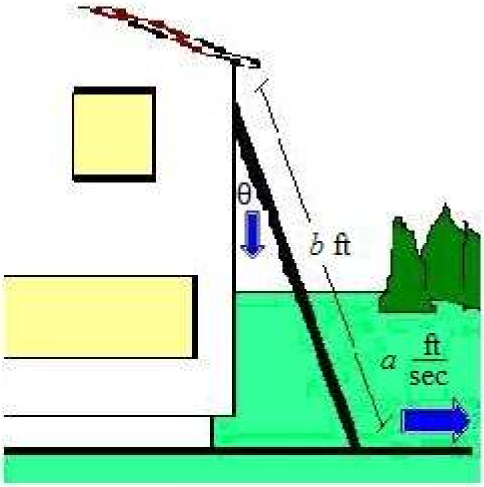
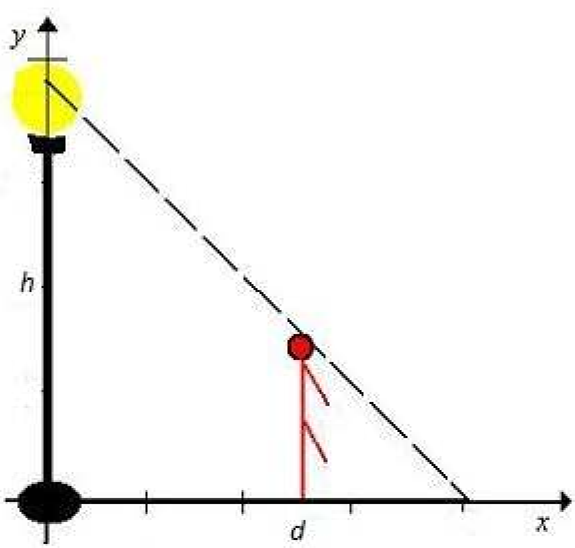


$a = 2$, $b = 25$

a. 0.112 rad/sec
b. 0.087 rad/sec
c. 2.260 rad/sec
d. 2.315 rad/sec
e. 0.347 rad/sec

ANSWER: b

13. A man 6 feet tall walks at a rate of 8 feet per second away from a light that is 15 feet above the ground (see the figure below). When he is 10 feet from the base of the light, at what rate is the tip of his shadow moving?



$h = 15$ ft, $d = 10$ ft

a. $\frac{5}{2}$ ft/sec

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b. 40 ft/sec

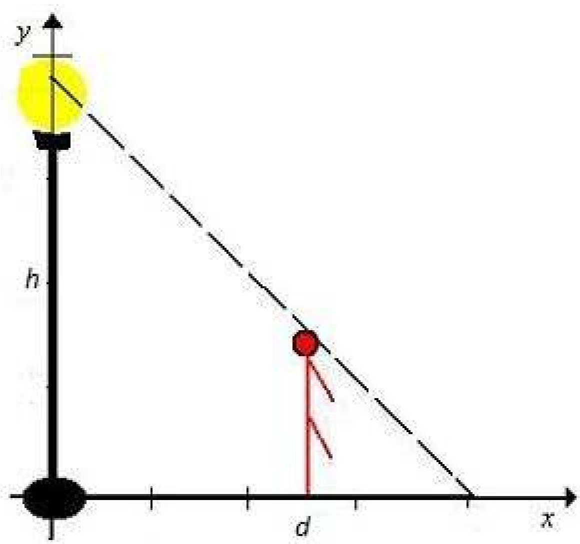
c. $\frac{3}{40}$ ft/sec

d. $\frac{9}{2}$ ft/sec

e. $\frac{40}{3}$ ft/sec

ANSWER: e

14. A man 6 feet tall walks at a rate of 11 feet per second away from a light that is 15 feet above the ground (see the figure below). When he is 13 feet from the base of the light, at what rate is the length of his shadow changing?



$h = 15$ ft, $d = 13$ ft

a. $\frac{9}{2}$ ft/sec

b. $\frac{55}{3}$ ft/sec

c. $\frac{22}{3}$ ft/sec

d. $\frac{3}{55}$ ft/sec

e. $\frac{1}{2}$ ft/sec

ANSWER: c

15. A man 6 feet tall walks at a rate of 4 ft per second away from a light that is 16 ft above the ground (see figure). When he is 8 ft from the base of the light, find the rate.at which the tip of his shadow is moving.

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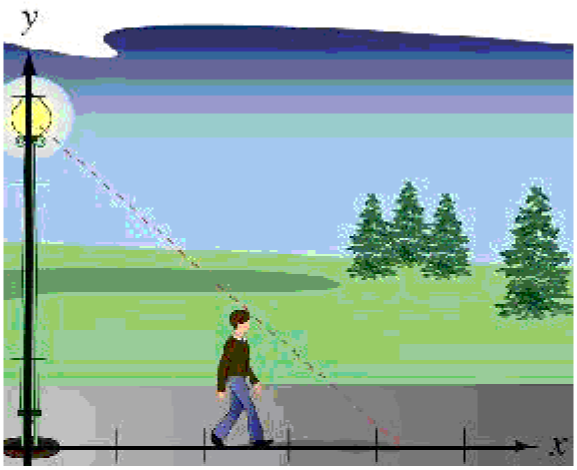

a. $\frac{16}{5}$ ft per minute

b. $\frac{8}{5}$ ft per minute

c. $\frac{128}{5}$ ft per minute

d. $\frac{64}{5}$ ft per minute

e. $\frac{32}{5}$ ft per minute

ANSWER: e

16. An airplane is flying in still air with an airspeed of 284 miles per hour. If it is climbing at an angle of 24°, find the rate at which it is gaining altitude. Round your answer to four decimal places.

a. 128.9333 mi/hr
b. 101.7765 mi/hr
c. 137.6859 mi/hr
d. 116.7334 mi/hr
e. 115.5132 mi/hr

ANSWER: e

