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Chapter 2

1. The slope of the tangent line $f(x) = -\frac{1}{2}x^2$ to the graph at the point (2,-2) is

a. -2
b. 2
c. $-\frac{1}{2}$
d. $\frac{1}{2}$
e. -4

ANSWER: a

2. The slope of the tangent line to the graph $f(x) = 3\sqrt{x}$ at the point (4,6) is

a. $-\frac{3}{4}$
b. $\frac{3}{4}$
c. $-\frac{4}{3}$
d. $\frac{4}{3}$
e. $\frac{3}{2}$

ANSWER: b

3. The slope of the tangent line to the graph $f(x) = \frac{1}{x^2}$ at the point (-1,1) is

a. -3
b. -2
c. -1
d. 1
e. 2

ANSWER: e

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4. The slope of the tangent line to the graph $f(x)=\frac{2}{x+4}$ at the point (-3, 2) is

a. -3
b. -2
c. 2
d. 3
e. 4

ANSWER: b

5. An equation of the tangent line to the graph $f(x)=x^2-x$ at the point (-2, 6) is

a. $y=-5x-4$
b. $y=-5x-2$
c. $y=-5x+2$
d. $y=-5x+3$
e. $y=-5x+4$

ANSWER: a

6. An equation of the tangent line to the graph $f(x)=2x-x^2$ at the point (-1,-3) is

a. $y=4x-3$
b. $y=4x-1$
c. $y=4x+1$
d. $y=4x+3$
e. $y=4x+5$

ANSWER: c

7. An equation of the tangent line to the graph $f(x)=\frac{3}{2x-1}$ at the point (1, 3) is

a. $y=-6x+9$
b. $y=-6x+3$
c. $y=-6x+1$
d. $y=-6x-1$
e. $y=-6x-3$

ANSWER: a

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8. An equation of the tangent line to the graph $f(x)=\sqrt{x+3}$ at the point (6, 3) is

a. $y=\frac{1}{6}x+3$

b. $y=\frac{1}{6}x+6$

c. $y=\frac{1}{6}x+2$

d. $y=\frac{1}{6}x+\frac{7}{3}$

e. $y=\frac{1}{6}x+\frac{5}{3}$

ANSWER: c

9. The instantaneous rate of change of $f(x)=4x-3$ at $c = 5$ is

a. -3
b. 4
c. 5
d. 17
e. 20

ANSWER: b

10. The instantaneous rate of change of $f(x)=\frac{8}{x+1}$ at $c = 3$ is

a. -2
b. -1
c. $-\frac{1}{2}$
d. $\frac{1}{2}$
e. 2

ANSWER: c

11. The instantaneous rate of change of $f(x)=3\sqrt{x+5}$ at $c = 4$ is

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a. $-\frac{3}{2}$

b. $-\frac{1}{2}$

c. $\frac{1}{2}$

d. 1

e. $\frac{3}{2}$

ANSWER: c

12. The instantaneous rate of change of $f(x) = 3x - 2x^2$ at $c = 2$ is

a. -5

b. -3

c. -2

d. 3

e. 5

ANSWER: a

13. The instantaneous rate of change of $f(x) = \frac{3}{x+1}$ at $c = 2$ is

a. -3

b. $-\frac{1}{3}$

c. $\frac{1}{3}$

d. 1

e.

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3

ANSWER: b

14. The instantaneous rate of change of $f(x)=\sqrt{x}+5$ at $c = 9$ is

a. $-\frac{1}{6}$

b. $-\frac{1}{3}$

c. $-\frac{1}{2}$

d. $\frac{1}{6}$

e. $\frac{1}{3}$

ANSWER: d

15. The derivative of $f(x)=3x^2-1$ at $x = –1$ is

a. -6

b. -3

c. -1

d. 3

e. 6

ANSWER: a

16. The derivative of $f(x)=\frac{4}{x}+5$ at $x = –2$ is

a. -4

b. -2

c. -1

d. 2

e. 4

ANSWER: c

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17. The derivative of $f(x)=\sqrt{x-4}$ at $x = 8$ is

a. $-\frac{1}{8}$
b. $-\frac{1}{4}$
c. $-\frac{1}{2}$
d. $\frac{1}{4}$
e. $\frac{1}{8}$

ANSWER: d

18. The derivative of $f(x)=-8x+7$ at $x = 0$ is

a. -8
b. 7
c. 0
d. 8
e. -7

ANSWER: a

19. The derivative of $f(x)=\frac{4}{x+5}$ at $x = –4$ is

a. -5
b. -4
c. 1
d. 4
e. 5

ANSWER: b

20. The derivative of $f(x)=\sqrt{x}-4$ at $x = 4$ is

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a. -4
b. $-\frac{1}{4}$
c. $-\frac{1}{2}$
d. $\frac{1}{4}$
e. $\frac{1}{2}$

ANSWER: d

21. A pump is used to empty a 350-gallon hot tub. The table shows the amount of water, $W(t)$, measured in gallons, remaining in the hot tub at time t, measured in minutes after the pump is turned on.

T	0	15	30	45	60	90
$W(t)$	350	320	280	225	170	105

Approximate $W'(30)$ in this context.

a. Water is draining at a rate of 28/3 gallons per minute when the pump has been operating for 30 minutes.
b. Forty gallons of water have been removed from the hot tub in 15 minutes of time.
c. There are 280 gallons of water in the hot tub 30 minutes after the pump is turned on.
d. Water is draining from the hot tub at a rate of 8/3 gallons per minute when the pump has been operating for 30 minutes.
e. Water is draining from the hot tub at a rate of 280 gallons per half-hour.

ANSWER: d

22. A dehumidifier is used to reduce the moisture in a basement. The level of moisture reported on the display panel when the dehumidifier is turned on is 70%. The percent moisture, $P(t)$, at time t is recorded for different times t in the table.

T	0	2	6	15	20	30
$P(t)$	70	67	60	53	51	50

Estimate $P'(20)$.

a. –0.20% per minute
b. –0.10% per minute
c. 0.10% per minute
d. 0.20% per minute
e. 0.40% per minute

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ANSWER: b

23. Let $f(x) = 4 - x^2$. Then $f'(x)$ is

a. -2x
b. $-x^2$
c. 2x
d. x^2
e. $4 - 2x$

ANSWER: a

24. Let $f(x) = \frac{1}{2} - 4x.$ Then $f'(x)$ is

a. -4
b. $-\frac{7}{2}$
c. $\frac{1}{2}$
d. $-\frac{1}{2}$
e. 4

ANSWER: a

25. Let $f(x) = \sqrt{9-x}.$ Then $f'(x)$ is

a. $\frac{\sqrt{9-x}}{2}$
b. $\frac{2}{\sqrt{9-x}}$
c. $\frac{1}{2\sqrt{9-x}}$
d. $-\frac{1}{2\sqrt{9-x}}$
e. $-\frac{2}{\sqrt{9-x}}$

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ANSWER: d

26. Let $f(x)=\frac{8}{\sqrt{4-x}}.$ Then $f'(x)$ is

a. $-\frac{4}{(4-x)^{\frac{3}{2}}}$

b. $-\frac{4}{(4-x)^{\frac{1}{2}}}$

c. $\frac{4}{(4-x)^{\frac{1}{2}}}$

d. $\frac{4}{(4-x)^{\frac{3}{2}}}$

e. $\frac{8}{(4-x)^{\frac{3}{2}}}$

ANSWER: d

27. Let $f(x)=\frac{3}{\sqrt{x}}+4.$ Then $f'(x)$ is

a. $-\frac{3}{2x^{\frac{3}{2}}}$

b. $-\frac{3}{2x^{\frac{3}{2}}}+4$

c. $\frac{3}{2x^{\frac{3}{2}}}$

d. $\frac{3}{x^{\frac{3}{2}}}$

e. $\frac{3}{2x^{\frac{3}{2}}}+4$

ANSWER: a

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28. Let $f(x)=x-\frac{2}{x}$. Then $f'(x)$ is

a. $1-\frac{3}{x^2}$

b. $1-\frac{2}{x^2}$

c. 1

d. $1+\frac{2}{x^2}$

e. $1+\frac{3}{x^2}$

ANSWER: d

29. Let $f(x)=\sqrt{9-x}.$ Then $f'(x)$ does not exist if x is

a. -9

b. -5

c. 5

d. 6

e. 9

ANSWER: e

30. Let $f(x)=\frac{3}{\sqrt{x}}+4$. Then does not exist if x is

a. 0

b. 1

c. 4

d. 9

e. 16

ANSWER: a

31. Let $f(x)=x-\frac{2}{x}$. Then $f'(x)$ does not exist if x is

a. -2

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b. -1
c. 0
d. 1
e. 2

ANSWER: c

32. Let $f(x)=\frac{8}{\sqrt{5-x}}.$ Then $f'(x)$ does not exist if x is

a. -5
b. 1
c. 2
d. 3
e. 5

ANSWER: e

33. Let $f(x)=|x|.$ Which of the following is true?

a. f is discontinuous at 0 .
b. f has a derivative at 0.
c. f has a corner at (0,0).
d. f has a horizontal tangent line at (0,0).
e. f has a vertical tangent line at (0,0).

ANSWER: c

34. Let $f(x)=\sqrt[3]{x}.$ Which of the following is true?

a. f is discontinuous at 0.
b. f has a derivative at 0.
c. f has a corner at (0,0).
d. f has a horizontal tangent line at (0,0).
e. f has a vertical tangent line at (0,0).

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ANSWER: e

35. Let $f(x) = \lfloor x \rfloor$. Which of the following is true?

a. f is discontinuous at 0.
b. f has a derivative at 0.
c. f has a corner at (0,0).
d. f has a horizontal tangent line at (0,0).
e. f has a vertical tangent line at (0,0).

ANSWER: a

36. Let $f(x) = -x^2$. Which of the following is true?

a. f is discontinuous at 0.
b. f does not have a derivative at 0.
c. f has a corner at (0,0).
d. f has a horizontal tangent line at (0,0).
e. f has a vertical tangent line at (0,0).

ANSWER: d

37. Let $f(x) = 2x^3$. Which of the following is true?

a. f is discontinuous at 0.
b. f does not have a derivative at 0.
c. f has a corner at (0,0).
d. f has a horizontal tangent line at (0,0).
e. f has a vertical tangent line at (0,0).

ANSWER: d

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38. Let $f(x)=\begin{cases}2x+1 & x<0\\ -x+1 & x>0\end{cases}$. Which of the following is true?

a. f is discontinuous at 0.
b. f has a derivative at 0.
c. f has a corner at (0,0).
d. f has a horizontal tangent line at (0,0).
e. f has a vertical tangent line at (0,0).

ANSWER: a

39. Let $f(x)=\begin{cases}x^2 & x\le 0\\ -x^2 & x>0\end{cases}$. Which of the following is true?

a. f is discontinuous at 0.
b. f does not have a derivative at 0.
c. f has a corner at (0,0).
d. f has a horizontal tangent line at (0,0).
e. f has a vertical tangent line at (0,0).

ANSWER: d

40. Let $f(x)=3x-2$. Which of the following is true?

a. f is discontinuous at 0.
b. f has a derivative at 0.
c. f has a corner at (0,0).
d. f has a horizontal tangent line at (0,0).
e. f has a vertical tangent line at (0,0).

ANSWER: b

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41. Let $f(x) = \lfloor x \rfloor$. Which of the following is true?

a. f is discontinuous at 0.

b. f has a derivative at 0.

c. f has a corner at (0,0).

d. f has a horizontal tangent line at (0,0).

e. f has a vertical tangent line at (0,0).

ANSWER: a

42. Let $f(x) = -4x + 2$. Which of the following is true?

a. f is discontinuous at 0.

b. f has a derivative at 0.

c. f has a corner at (0,0).

d. f has a horizontal tangent line at (0,0).

e. f has a vertical tangent line at (0,0).

ANSWER: b

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43. Let $f(x)=\frac{1}{e}$. Then $f'(x)$ is

a.

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b.

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c.

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d.

e. 0

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ANSWER: e

44. Let $f(x)=\frac{5}{\pi}.$ Then $f'(x)$ is

a. 0
b. $-\frac{5}{\pi^2}$
c. $-\frac{5}{\pi}$
d. $\frac{5}{\pi}$
e. $\frac{5}{\pi^2}$

ANSWER: a

45. Let $f(x)=\frac{1}{2}x^2-3x+4.$ Then $f'(x)=0$ if x is

a. -3
b. -1
c. 0
d. 1
e. 3

ANSWER: e

46. Let $f(x)=\frac{x^3-2x^2}{x}.$ Then $f'(x)=0$ if x is

a. -2
b. -1
c. 0
d. 1
e. 2

ANSWER: d

47. Let $f(x)=x-e^x.$ Then $f'(x)=0$ if x is

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a. $-e$
b. -1
c. 0
d. 1
e. e

ANSWER: c

48. Let $f(x) = 6x - e^x$. Then $f'(x) = 0$ if x is

a. -6
b. $-\ln 6$
c. 0
d. $\ln 6$
e. 6

ANSWER: d

49. Let $f(x) = \frac{1}{2}x^2 - 3x + 4$. Then $f'(x) = 0$ for all x in

a. $(-\infty, \infty)$
b. $(-\infty, -3)$
c. $(-3, \infty)$
d. $(-3, 3)$
e. $(3, \infty)$

ANSWER: e

50. Let $f(x) = \frac{x^3 - 2x^2}{x}$. Then $f'(x) = 0$ for all x in

a. $(-\infty, \infty)$
b. $(-\infty, 0)$
c. $(-1, \infty)$
d. $(-\infty, 0) \cup (1, \infty)$
e. $(1, \infty)$

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ANSWER: e

51. Let $f(x) = x - e^x$. Then $f'(x) = 0$ for all x in

a. $(-\infty, \infty)$
b. $(-\infty, 0)$
c. $(0, \infty)$
d. $(-\infty, e)$
e. $(-\infty, e^2)$

ANSWER: b

52. Let $f(x) = 6x - e^x$. Then $f'(x) = 0$ for all x in

a. $(-\infty, \infty)$
b. $(-\infty, \ln 6)$
c. $(\ln 6, \infty)$
d. $(-\infty, 6)$
e. $(-\infty, -\ln 6)$

ANSWER: b

53. Let $f(x) = 6x - e^x$. Then which of the following is the largest interval, of those listed, for which $f'(x) > 0$ for all x in that interval?

a. $(-\infty, \infty)$
b. $(-\infty, \ln 6)$
c. $(\ln 6, \infty)$
d. $(-\infty, -\ln 6)$
e. $(-\infty, -\ln 6)$

ANSWER: a

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54. Let $f(x) = x^3 - 6x^2$. Then which of the following is the largest interval, of those listed, for which $f'(x) > 0$ for all x in that interval?

a. $(4, \infty)$
b. $(-\infty, 0)$
c. $(0, 4)$
d. $(-\infty, 0) \cup (4, \infty)$
e. $(-\infty, \infty)$

ANSWER: d

55. Let $f(x) = \frac{1}{2}x^2 - 3x + 4.$ Then which of the following is the largest interval, of those listed, for which $f'(x) > 0$ for all x in that interval?

a. $(-\infty, \infty)$
b. $(-\infty, -3)$
c. $(-\infty, 3)$
d. (-3,3)
e. $(3, \infty)$

ANSWER: c

56. Let $f(x) = x - e^x$. Then $f'(x) < 0$ for all x in

a. $(-\infty, \infty)$
b. $(-\infty, 0)$
c. $(0, \infty)$
d. $(-\infty, e)$
e. $(-\infty, e^2)$

ANSWER: c

57. Let $f(x) = 6x - e^x$. Then which of the following is the largest interval, of those listed, for which $f'(x) < 0$ for all x in that interval?

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a. $(-\infty, \infty)$

b. $(-\infty, \ln 6)$

c. $(\ln 6, \infty)$

d. $(-\infty, 6)$

e. $(-\infty, -\ln 6)$

ANSWER: c

58. Let $f(x) = x + e^x$. Then which of the following is the largest interval, of those listed, for which $f'(x) < 0$ for all x in that interval?

a. $(-\infty, \infty)$

b. $(-\infty, 0)$

c. $(0, \infty)$

d. $(-\infty, 3)$

e. $\varnothing$

ANSWER: e

59. Let $f(x) = e^x$. Then which of the following is the largest interval, of those listed, for which $f'(x) < 0$ for all x in that interval?

a. $(-\infty, \infty)$

b. $(-\infty, 0)$

c. $(0, \infty)$

d. $(-\infty, 3)$

e. $\varnothing$

ANSWER: e

60. Let $f(x) = x - 4e^x$. Then which of the following is the largest interval, of those listed, for which $f'(x) < 0$ for all x in that interval?

a. $(-\infty, \infty)$

b. $(-\infty, -\ln 4)$

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c. $(-\ln 4, \ln 4)$

d. $(-\ln 4, \infty)$

e. $\varnothing$

ANSWER: d

61. Let $f(x) = 4e^x + 3x$. Then which of the following is the largest interval, of those listed, for which for all x in that interval?

a. $(-\infty, \infty)$

b. $(-\infty, -\ln\frac{3}{4})$

c. $(-\ln\frac{3}{4}, \ln\frac{3}{4})$

d. $(-\infty, \ln\frac{3}{4})$

e. $\varnothing$

ANSWER: e

62. Let $f(x) = x^3 - 6x^2$. Then which of the following is the largest interval, of those listed, for which $f'(x) < 0$ for all x in that interval?

a. $(4, \infty)$

b. $(-\infty, 0)$

c. (0,4)

d. $(-\infty, 0) \cup (4, \infty)$

e. $(-\infty, \infty)$

ANSWER: c

63. What is the equation of the normal line to the graph of $f(x) = x^2 - 2x$ at $x = 1$?

a. $y = x$

b. $y = -x$

c. $y + 1 = x - 1$

d. $x = 1$

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e. $y = -1$

ANSWER: d

64. What is the equation of the normal line to the graph of $f(x) = 3\sqrt{x} + 2$ at $x = 9$?

a. $y = -2x$

b. $y - 11 = -2(x - 9)$

c. $y - 11 = 0.5(x - 9)$

d. $y = 0.5x$

e. $y = 0.5x - 9$

ANSWER: b

65. Let $f(x) = (x-2)^2$. Then $f'(x)$ is

a. $2x - 4$

b. $2x + 4$

c. $-2x - 4$

d. $-2x + 4$

e. $2x + 8$

ANSWER: a

66. Let $f(x) = -3(x+5)^2$. Then $f'(x)$ is

a. $-6x$

b. $-6x - 15$

c. $-6x - 30$

d. $-6x + 15$

e. $-6x + 30$

ANSWER: c

67. Let $f(x) = (-3x+5)^2$. Then $f'(x)$ is

a. $-6x$

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b. $-6x-10$

c. $18x-30$

d. $18x+30$

e. $18x-5$

ANSWER: c

68. Let $f(x)=4x^3e^x$. Then $f'(x)$ is

a. $12x^2e^x$

b. $12x^2+e^x$

c. $4x^2(x+3)$

d. $4x^2e^x(x+3)$

e. $4x^3e^{x-1}$

ANSWER: d

69. Let e^x / x^4. Then $f'(x)$ is

a. $\dfrac{e^x}{x^4}$

b. $\dfrac{e^x(x-4)}{x^8}$

c. $\dfrac{e^x(x-4)}{x^7}$

d. $\dfrac{e^x(x-4)}{x^6}$

e. $\dfrac{e^x(x-4)}{x^5}$

ANSWER: e

70. Let $f(x)=\dfrac{x^4}{e^x}$. Then $f'(x)$ is

a. $\dfrac{4x^3}{e^x}$

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b. $\frac{x^4}{e^x}$

c. $\frac{x^3(4-x)}{e^x}$

d. $\frac{x^3(4-x)}{e^{2x}}$

e. $\frac{x^4-3}{e^x}$

ANSWER: c

71. Let $f(x)=\frac{1-x}{1+x}$. Then $f'(x)$ is

a. $-\frac{2}{(1+x)^2}$

b. $\frac{2}{(1+x)^2}$

c. $-\frac{2x}{(1+x)^2}$

d. $\frac{2x}{(1+x)^2}$

e. $-\frac{2}{1+x}$

ANSWER: a

72. Let $f(x)=\frac{3}{x^2+1}$. Then $f'(x)$ is

a. $-\frac{6x}{x^2+1}$

b. $\frac{6x}{x^2+1}$

c. $-\frac{6x}{(x^2+1)^2}$

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d. $\dfrac{6x}{(x^2+1)^2}$

e. $-\dfrac{3x}{(x^2+1)^2}$

ANSWER: c

73. Let $f(x)=x^4-\dfrac{4}{x^4}$. Then $f'(x)$ is

a. $4x^3-\dfrac{1}{x^3}$

b. $4x^3-\dfrac{4}{x^5}$

c. $4x^3-\dfrac{16}{x^5}$

d. $4x^3+\dfrac{4}{x^5}$

e. $4x^3+\dfrac{16}{x^5}$

ANSWER: e

74. Let $f(x)=\dfrac{4x}{3x+5}$. Then $f'(x)$ is

a. $\dfrac{4}{3}$

b. $\dfrac{20}{3x+5}$

c. $-\dfrac{20}{(3x+5)^2}$

d. $\dfrac{20}{(3x+5)^2}$

e. $\dfrac{24x-5}{(3x+5)^2}$

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ANSWER: d

75. Let $f(x) = 3xe^x$. Then $f'(x)$ is

a. $3e^x$

b. $3e^x + 3x^2e^{x-1}$

c. $3xe^{x-1}$

d. $3e^x(x+2)$

e. $3e^x(x+1)$

ANSWER: d

76. Let $f(x) = \frac{e^x}{x}$. Assuming $x \neq 0, f'(x)$ is

a. e^x

b. $-\frac{e^x}{x^2}$

c. $\frac{e^x(1-x)}{x^2}$

d. $\frac{e^x(x-1)}{x^2}$

e. $\frac{e^{x-1}(x-1)}{x}$

ANSWER: d

77. Let $f(x) = e^2x^3$. Then $f'(x)$ is

a. $3x^2e^2$

b. $6xe^2$

c. $12xe$

d. $6x^2e^2$

e. $12x^2e$

ANSWER: b

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78. Let $f(x)=\frac{x^2+x}{x}$. Assuming $x \neq 0, f'(x)$ is

a. $\frac{1}{2}$

b. 0

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

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

e. $\frac{x}{2}-1$

ANSWER: b

79. Let $f(x)=x^3-4x^2+x-5.$ Then $f'(x)$ is

a. $6x-8$

b. $6x$

c. $3x^2-8x$

d. $-6x$

e. -6

ANSWER: a

80. The fourth derivative $\frac{d^4}{dx^4}\left(x^2-e^x\right)$ is

a. $2x-e^x$

b. $2-e^x$

c. $2+e^x$

d. $-e^x$

e. e^x

ANSWER: d

81. The fifth derivative $\frac{d^5}{dx^5}\left(5x^4-e^x\right)$ is

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a. $60x^3 - e^x$
b. $180x^2 - e^x$
c. $360x - e^x$
d. $360 - e^x$
e. $-e^x$

ANSWER: e

82. The second derivative $\frac{d^2}{dx^2}\left((x^2-1)(x+2)\right)$ is

a. $3x^2 + 4x - 1$
b. $2x$
c. 0
d. $6x + 4$
e. $6x - 4$

ANSWER: d

83. The sixth derivative $\frac{d^6}{dx^6}\left(x^6 - 3x^3 + 5\right)$ is

a. 720
b. $72x$
c. 0
d. -720
e. x
-720

ANSWER: a

84. Let $f(x) = \pi^2 e^x$. Then $f^{(10)}(x)$ is

a. $2\pi e^x$
b. 0
c. $10\pi e^x$
d. πe^x

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e. $\pi^2 e^x$

ANSWER: e

85. Let $f(x) = x^2 \sin x$. Then $f'(x)$ is

a. $2x \cos x$
b. $x(\sin x + \cos x)$
c. $x(2 \sin x + x \cos x)$
d. $x(x \sin x + 2 \cos x)$
e. $x(2 \sin x + \cos x)$

ANSWER: c

86. Let $f(x) = \dfrac{1 + \cos x}{\sin x}$. Then $f'(x)$ is

a. $-\tan x$
b. $\cot x$
c. $-\cot x - \csc x$
d. $-\csc x(\cot x + \csc x)$
e. $-\csc x(\cot x - \csc x)$

ANSWER: d

87. Let $f(x) = \dfrac{\sin x}{e^x}$. Then $f'(x)$ is

a. $e^x(\cos x + \sin x)$
b. $e^x(\cos x - \sin x)$
c. $\dfrac{\cos x + \sin x}{e^x}$
d. $\dfrac{\cos x - \sin x}{e^x}$
e. $\dfrac{\cos x - \sin x}{e^{2x}}$

ANSWER: d

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88. Let $f(x)=\dfrac{1-\tan x}{\sin x}$. Then $f'(x)$ is

a. $\csc x \cot x + \sec x \tan x$
b. $\csc x \cot x - \sec x \tan x$
c. $-\csc x \cot x + \sec x \tan x$
d. $-\csc x \cot x - \sec x \tan x$
e. $\csc x \tan x - \sec x \cot x$

ANSWER: d

89. Let $f(x)=\dfrac{\sin x}{1-\cos^2 x}$. Then $f'(x)$ is

a. $1+\cot^2 x$
b. $-\csc x$
c. $-\csc x \cot x$
d. $\csc x \cot x$
e. $\sec x \tan x$

ANSWER: c

90. Let $f(x)=\sin x \cos x$. Then $f'(x)$ is

a. $\sin^2 x - \cos^2 x$
b. $\cos^2 x - \sin^2 x$
c. 1
d. $2 \sin x \cos x$
e. $-2 \sin x \cos x$

ANSWER: b

91. Let $f(x)=x^2 \cos x$. Then $f'(x)$ is

a. $x(2 \sin x + x \cos x)$
b. $x(2 \sin x - x \cos x)$
c. $x(2 \cos x + x \sin x)$
d. $x(2 \cos x - x \sin x)$

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e. $x(\sin x - 2\cos x)$

ANSWER: d

92. Let $f(x) = 2\cos x + x.$ If $x \in [0, 2\pi],$ then *f* has a horizontal tangent line for each *x* in

a. $\left\{\frac{\pi}{6}, \frac{5\pi}{6}\right\}$

b. $\left\{\frac{5\pi}{6}, \frac{7\pi}{6}\right\}$

c. $\left\{\frac{\pi}{6}, \frac{11\pi}{6}\right\}$

d. $\left\{\frac{5\pi}{6}, \frac{11\pi}{6}\right\}$

e. $\left\{\frac{7\pi}{6}, \frac{11\pi}{6}\right\}$

ANSWER: a

93. Let $f(x) = \sin x - x.$ If $x \in [0, 2\pi],$ then *f* has a horizontal tangent line for each *x* in

a. $\left\{\frac{\pi}{2}\right\}$

b. $\{\pi\}$

c. $\left\{\frac{3\pi}{2}\right\}$

d. $\{2\pi\}$

e. $\{0, 2\pi\}$

ANSWER: e

94. Let $f(x) = \cos x - 2x.$ If $x \in [0, 2\pi],$ then *f* has a horizontal tangent line for each *x* in

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a. $\left\{\frac{\pi}{6}\right\}$

b. $\left\{\frac{5\pi}{6}\right\}$

c. $\left\{\frac{7\pi}{6}\right\}$

d. $\left\{\frac{11\pi}{6}\right\}$

e. $\varnothing$

ANSWER: e

95. Let $f(x) = \sin x - e^x.$ If $x \in [0, 2\pi]$, then f has a horizontal tangent line for each x in

a. $\left\{\frac{\pi}{2}\right\}$

b. $\{\pi\}$

c. $\left\{\frac{3\pi}{2}\right\}$

d. $\{2\pi\}$

e. $\{0\}$

ANSWER: e

96. Let $f(x) = \cos x + e^x.$ If $x \in [0, 2\pi]$, then f has a horizontal tangent line for each x in

a. $\left\{\frac{\pi}{2}\right\}$

b. $\{\pi\}$

c. $\left\{\frac{3\pi}{2}\right\}$

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d. $\{2\pi\}$

e. $\varnothing$

ANSWER: e

97. Let $f(x) = \cos x - e^x.$ $x \in [0, 2\pi],$ If then f has a horizontal tangent line for each x in

a. $\left\{\frac{\pi}{2}\right\}$

b. $\{\pi\}$

c. $\left\{\frac{3\pi}{2}\right\}$

d. $\{2\pi\}$

e. $\varnothing$

ANSWER: e

98. Let $f(x) = \sin x - e^x.$ $x \in [-\pi, 3\pi],$ If then f has a horizontal tangent line for each x in

a. 0

b. $\left\{\frac{\pi}{2}\right\}$

c. $\{\pi\}$

d. $\left\{\frac{3\pi}{2}\right\}$

e. $\{0, 2\pi\}$

ANSWER: a

99. Let $y = x \cos x$. Then y'' is

a. $2\sin x - x\cos x$

b. $2\cos x - x\sin x$

c. $2\sin x + x\cos x$

d. $2\cos x + x\sin x$

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e. $-2\sin x - x\cos x$

ANSWER: e

100. Let $y = x\sin x$. Then y'' is

a. $2\sin x - x\cos x$
b. $2\cos x - x\sin x$
c. $2\sin x + x\cos x$
d. $2\cos x + x\sin x$
e. $-2\sin x - x\cos x$

ANSWER: b

101. Let $y = e^x \sin x$. Then y'' is

a. $2e^x \cos x$
b. $2e^x \sin x$
c. $-2e^x \cos x$
d. $-2e^x \sin x$
e. $e^x(\sin x + \cos x)$

ANSWER: a

102. Let $y = e^x \cos x$. Then y'' is

a. $-2e^x \sin x$
b. $-2e^x \cos x$
c. $2e^x \sin x$
d. $2e^x \sin x$
e. $e^x(\sin x - \cos x)$

ANSWER: a

103. Let $y = 3\sin x - 2\cos x$. Then y'' is

a. $-3\sin x - 2\cos x$
b. $-3\sin x + 2\cos x$

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c. $3\sin x - 2\cos x$

d. $3\sin x + 2\cos x$

e. $2\sin x - 3\cos x$

ANSWER: b

104. Let $y = 3\sin x + 2\cos x.$ Then y'' is

a. $-3\sin x - 2\cos x$

b. $-3\sin x + 2\cos x$

c. $3\sin x - 2\cos x$

d. $3\sin x + 2\cos x$

e. $2\sin x - 3\cos x$

ANSWER: a