1. Solve the equation $3^{4x+5} = 6$ for x.

(a) $x = \dfrac{\ln(6)/\ln(3) - 5}{4\ln(3)}$

(b) $x = \dfrac{\ln(5)/\ln(3) - 6}{4}$

(c) $x = \dfrac{\ln(6)/\ln(3) - 5}{4}$

(d) $x = \dfrac{\ln(6) - 5/\ln(3)}{4}$

(e) $x = \dfrac{\ln(3)/\ln(6) - 5}{4}$

2. Solve the equation $e^{x^2-1} = 1$ for x.

(a) $x = 1$ only

(b) $x = 1$ and $x = -1$

(c) $x = -1$ only

(d) $x = 0$ only

(e) $x = 1$ and $x = 0$

3. Solve the equation $\ln(2x + 3) = 4$ for x.

(a) $x = \dfrac{e^3 - 4}{2}$

(b) $x = \dfrac{e^4 - 3}{2}$

(c) $x = \dfrac{\ln(4) - 3}{2}$

(d) $x = \dfrac{e^4 - 2}{\ln(3)}$

(e) $x = \dfrac{\ln(4) - \ln(3)}{2}$

4. The domain of $f(x) = \dfrac{\sqrt{2-x}}{x}$ is ________.

(a) $x \neq 0$

(b) $2 \leq x,\ x \neq 0$

(c) $x < 2,\ x \neq 0$

(d) $x \leq 2,\ x \neq 0$

(e) $2 < x,\ x \neq 0$

5. The domain of $f(x) = \dfrac{x}{4x^2 - 1}$ is ________.

(a) $x \neq \pm\frac{1}{2},\ x \neq 0$

(b) $x \neq \pm\frac{1}{2}$

(c) $x \neq \frac{1}{2}$

(d) $x \neq \frac{1}{2},\ x \neq 0$

(e) $x \neq \pm 2$

6. The domain of $f(x) = \sqrt{\dfrac{2x-3}{4x+5}}$ is ________.

(a) $-\frac{5}{4} < x \leq \frac{3}{2}$

(b) $x < -5/4,\ x \geq 3/2$

(c) $x < -5/4$

(d) $x \geq 3/2$

(e) $x > 0$

7. $f(x) = \dfrac{x+2}{3x-4}$. Find $f^{-1}(x)$ (the inverse of f).

(a) There is no inverse

(b) $f^{-1}(x) = \dfrac{4x+2}{3x-1}$

(c) $f^{-1}(x) = \dfrac{3x-1}{4x+2}$

(d) $f^{-1}(x) = (4x+2)(3x-1)$

(e) $f^{-1}(x) = \dfrac{3x-4}{x+2}$

8. $f(x) = x^2 - 2x + 1$. Find $f^{-1}(x)$ (the inverse of f).

(a) There is no inverse

(b) $f^{-1}(x) = \sqrt{x} + 1$

(c) $f^{-1}(x) = \sqrt{x+1}$

(d) $f^{-1}(x) = -\sqrt{x} + 1$

(e) $f^{-1}(x) = \sqrt{x} - 1$

9. $f(x) = e^{2x+3}$. Find $f^{-1}(x)$ (the inverse of f).

(a) There is no inverse

(b) $f^{-1}(x) = \dfrac{\ln(x) - 3}{2}$

(c) $f^{-1}(x) = \dfrac{\ln(x) + 3}{2}$

(d) $f^{-1}(x) = \dfrac{\ln(x) - 2}{3}$

(e) $f^{-1}(x) = \dfrac{\ln(x) + 2}{3}$

10. $\displaystyle\lim_{x \to 2} \frac{x^2 - 4}{x^2 + x + 4} =$ ________

(a) 4

(b) -2

(c) 0

(d) 2

(e) Does not exist

11. $\displaystyle\lim_{x \to -3} \frac{x^2 + 4x + 3}{x^2 + 2x - 3} =$ ________

(a) Does not Exist

(b) $\dfrac{1}{2}$

(c) 0

(d) $-\dfrac{1}{2}$

(e) 1

12. $\displaystyle\lim_{x \to 2} \frac{x^2 + x + 4}{x^2 - 4} =$ ________

(a) 4

(b) -2

(c) 0

(d) 2

(e) ∞

13. $\lim_{h \to 0} \frac{\frac{1}{1+h} - 1}{h} =$ ________.

(a) Does not exist

(b) 0

(c) 1

(d) -1

(e) $\frac{1}{2}$

14. $\lim_{h \to 0} \frac{(2+h)^2 - 4}{h} =$ ________

(a) Does not exist

(b) $-\frac{1}{4}$

(c) $\frac{1}{4}$

(d) 0

(e) 4

15. $\lim_{h \to 0} \frac{\sqrt{h+4} - 2}{h} =$ ________.

(a) Does not exist

(b) $-\frac{1}{4}$

(c) $\frac{1}{4}$

(d) 0

(e) 4

16. If $f(x) = x^2 \cos(x)$, then $f''(0) =$ ________.

(a) 1

(b) 0

(c) 2

(d) -1

(e) -2

17. If $f(x) = (2x+5)^3$, then $f''(0) =$ ________

(a) 125 (b) 40

(c) 0 (d) 8

(e) 120

18. If $f(x) = x^3 + \ln(x)$, then $f''(1) =$ ________

(a) -3 (b) -1

(c) 0 (d) 5

(e) 3

19. If $f(x) = x\cos(2x+3)$, then $f'(x) =$ ________

(a) $x\cos(2x+3) - 2\sin(2x+3)$ (b) $-\cos(2x+3) - 2x\sin(2x+3)$

(c) $\cos(2x+3) + 2x\sin(2x+3)$ (d) $\cos(2x+3) - 2x\sin(2x+3)$

(e) $2x\cos(2x+3) - \sin(2x+3)$

20. If $f(x) = \ln(x^2+2x-1)$, then $f'(x) =$ ________.

(a) $\dfrac{1}{2x+2}$ (b) $\dfrac{1}{x^2+2x-1}$

(c) $\dfrac{2x+2}{x^2+2x-1}$ (d) $\ln(2x+2)$

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

21. If $f(x) = \cos(x^3)$ then $f'(x) =$ ________

(a) $-x^2\sin(x^3)$ (b) $-\sin(x^3)$

(c) $-3x^2\sin(x^3)$ (d) $-\sin(3x^2)$

(e) $\sin(3x^2)$

22. If $f(x) = \dfrac{1}{x^2 - x + 1}$, then $f'(0) =$ ________

(a) 0

(b) 1

(c) -1

(d) $\dfrac{1}{2}$

(e) $-\dfrac{1}{2}$

23. If $f(x) = \dfrac{\sin(2x)}{\cos(x)}$, then $f'(0) =$ ________

(a) 0

(b) -2

(c) -1

(d) 2

(e) 1

24. If $f(x) = \dfrac{x^2 - 1}{x^2 + 1}$, then $f'(0) =$ ________

(a) 1

(b) 0

(c) -1

(d) 2

(e) -2

25. The equation of the tangent line to the curve given by $y = x^3 - 2x + 1$ at the point where $x = -1$ is ________.

(a) $y = x + 3$

(b) $y = 3x + 3$

(c) $y = 3x^2 + 3$

(d) $y = 3x^2 - 2$

(e) $y = x - 3$

26. The equation of the tangent line to the curve given by $y = \dfrac{1}{\sqrt{x+2}}$ at the point where $x = -1$ is ________.

(a) $y = -\frac{3}{2}x + \frac{1}{2}$ (b) $y = -\frac{1}{2}x - \frac{3}{2}$

(c) $y = -\frac{1}{2}x + \frac{3}{2}$ (d) $y = -\frac{1}{2}x - \frac{1}{2}$

(e) $y = -\frac{1}{2}x + \frac{1}{2}$

27. The equation of the tangent line to the curve given by $y = x\cos(x)$ at the point where $x = 0$ is ________.

(a) $y = 2x$ (b) $y = x + 1$

(c) $y = 1$ (d) $y = x$

(e) $y = x - 1$

28. The slope to the tangent line to the curve given by $x^2 - 2xy + y^3 = 8$ at the point $(0, 2)$ is ________.

(a) $\frac{1}{5}$ (b) $\frac{1}{4}$

(c) $\frac{1}{7}$ (d) $\frac{1}{6}$

(e) $\frac{1}{3}$

29. The slope to the tangent line to the curve given by $x^3 + 1 = x + y^3$ at the point $(1, 1)$ is ________.

(a) -2 (b) $-\frac{3}{2}$

(c) $\frac{3}{2}$ (d) $-\frac{2}{3}$

(e) $\frac{2}{3}$

30. The slope to the tangent line to the curve given by $x + xy = x^3 + y^3$ at the point $(1, 1)$ is ________.

(a) $-\frac{1}{3}$
(b) $-\frac{1}{5}$
(c) $-\frac{1}{4}$
(d) $-\frac{1}{2}$
(e) -1

31. Find the rate of change of y with respect to x at the point where $x = \pi$ if $y = \cos(x)$.

(a) 0
(b) π
(c) 1
(d) -1
(e) $-\pi$

32. Find the rate of change of y with respect to x at the point where $x = 4$ if $y = \frac{1}{\sqrt{x}}$.

(a) -1
(b) $-\frac{1}{36}$
(c) $-\frac{1}{4}$
(d) $-\frac{1}{16}$
(e) $-\frac{1}{8}$

33. Find the rate of change of y with respect to x at the point where $x = 1$ if $y = \ln(2^x)$.

(a) 2
(b) $-\frac{1}{2}$
(c) $\frac{1}{2}$
(d) $\ln 2$
(e) -2

34. The graph of $y = x^4 - x^2$ has how many critical points?

(a) 1 (b) 0

(c) 3 (d) 4

(e) 2

35. The graph of $y = x^3 - 6x^2 + 12x$ has how many critical points?

(a) 0 (b) 2

(c) 4 (d) 3

(e) 1

36. The graph of $y = \dfrac{1}{1+x^2}$ has how many critical points?

(a) 0 (b) 2

(c) 4 (d) 3

(e) 1

37. The graph of $y = \dfrac{x}{1+x^2}$ has how many local maximums?

(a) 0 (b) 1

(c) 2 (d) 3

(e) 4

38. The graph of $y = x^4 - x^3$ has how many local minimums?

(a) 3 (b) 4

(c) 2 (d) 1

(e) 0

39. The graph of $y = x^4 + x^2$ has how many local maximums?

(a) 4 (b) 0

(c) 3 (d) 2

(e) 1

40. The area of a square is increasing at the rate of 2 square inches per minute. How fast is each side increasing at the instant when the side is equal to 3 inches?

(a) $\frac{1}{4}$ in/min (b) 2 in/min

(c) 1 in/min (d) $\frac{1}{2}$ in/min

(e) $\frac{1}{3}$ in/min

41. The volume of a sphere is increasing at a rate of 10 cubic miles per day. How fast is the radius increasing at the instant when the radius is equal to 1 mile? (The volume of a sphere is $\frac{4}{3}\pi r^3$ where r is the sphere's radius.)

(a) $\frac{10}{\pi}$ miles/day (b) $\frac{2}{\pi}$ miles/day

(c) $\frac{5}{2\pi}$ miles/day (d) $\frac{5}{3\pi}$ miles/day

(e) $\frac{3}{\pi}$ miles/day

42. The area enclosed by a circle is increasing at a rate of 10 square meters per second. How fast is the circumference increasing at the instant when the radius of the circle is equal to 4 meters?

(a) $\frac{4}{3}$ metes/sec (b) $\frac{3}{4}$ metes/sec

(c) $\frac{5}{4}$ metes/sec (d) $\frac{5}{2}$ metes/sec

(e) $\frac{5}{3}$ metes/sec

43. Find the absolute maximum value of the function $f(x) = x^2 - 2x + 1$ on the interval $[-2, 2]$.

(a) 1

(b) 9

(c) 0

(d) 12

(e) 10

44. Find the absolute minimum value of the function $f(x) = x^3 - 27x$ on the interval $[-5, 5]$.

(a) -27

(b) -30

(c) -54

(d) -48

(e) -64

45. Find the absolute minimum value of the function $f(x) = x^4 - 2x^2$ on the interval $[-1, 2]$.

(a) -2

(b) -1

(c) 0

(d) -3

(e) -4

46. The function $f(x) = \dfrac{3x^3 - 2x^2 + 4x - 5}{x^2 - 2x + 16}$ has a horizontal asymptote at

(a) f has no horizontal asymptote

(b) $y = 0$

(c) $y = 3$

(d) $y = 1$

(e) $y = -3$

47. The function $f(x) = \dfrac{2x^3 + 4x^2 + 4x + 5}{3x^3 + x^2 - 4x + 17}$ has a horizontal asymptote at

(a) f has no horizontal asymptote (b) $y = \dfrac{5}{17}$

(c) $y = 2$ (d) $y = \dfrac{2}{3}$

(e) $y = 0$

48. The function $f(x) = 2 - \dfrac{1}{1 + x^2}$ has a horizontal asymptote at

(a) f has no horizontal asymptote (b) $y = 0$

(c) $y = 1$ (d) $y = 2$

(e) $y = -1$

49. The graph of the function $f(x) = 1 - \dfrac{1}{x}$ has a vertical asymptote at

(a) f has no vertical asymptote (b) $x = 1$ only

(c) $x = 0$ only (d) $x = 0$ and $x = 1$

(e) $x = 0$ and $x = 2$

50. The graph of the function $f(x) = \dfrac{x^2 - 9}{x^2 - 6x + 9}$ has a vertical asymptote at

(a) f has no vertical asymptote (b) $x = -3$ and $x = 0$

(c) $x = 3$ and $x = 0$ (d) $x = 3$ only

(e) $x = -3$ only

51. The graph of the function $f(x) = \dfrac{x^2 - 4}{x^2 + 4}$ has a vertical asymptote at

(a) f has no vertical asymptote (b) $x = 2$ only

(c) $x = -2$ only (d) $x = -2$ and $x = 0$

(e) $x = 1$ and $x = -1$

52. The graph of the function $f(x) = \dfrac{1}{3 + x^2}$ has inflection points at

(a) f has no inflection points (b) $x = 1$ only

(c) $x = \sqrt{3}$ only (d) $x = 1$ and $x = -1$

(e) $x = 1$ and $x = \sqrt{3}$

53. The graph of the function $f(x) = x^4 + x^2$ has inflection points at

(a) f has no inflection points (b) $x = 0$ only

(c) $x = \sqrt{2}$ only (d) $x = 1$ only

(e) $x = -1$ only

54. The graph of the function $f(x) = x^4 - 4x^3 + 6x^2$ has inflection points

(a) f has no inflection points (b) $x = 1$ only

(c) $x = -1$ only (d) $x = 0$ only

(e) $x = 1$, $x = -1$ and $x = 0$

55. $\displaystyle\lim_{x \to 0} \frac{\sin(2x) + x}{\sin(3x)} =$ ______

(a) 0 (b) $\dfrac{2}{3}$

(c) 1 (d) 2

(e) ∞

56. $\lim_{x\to 1} \frac{\ln x}{x^2-1} =$ ________.

(a) $\frac{1}{2}$

(b) 0

(c) 2

(d) 1

(e) ∞

57. $\lim_{x\to 1} \frac{\ln(2x)}{x-1} =$ ________.

(a) $\frac{1}{2}$

(b) 0

(c) 2

(d) 1

(e) ∞

58. Of all of the pairs of positive real numbers x and y for which $x^2+y^2=1$, determine the largest possible value of xy^2.

(a) $\sqrt{3}$

(b) $\sqrt{\frac{2}{3}}$

(c) $\frac{2}{3\sqrt{3}}$

(d) $\frac{2}{3}$

(e) $\frac{\sqrt{2}}{3}$

59. Of all of the rectangles in which the width (w) and height (h) satisfy the relation $w^2+2h^2=16$, determine the largest enclosed area.

(a) $\sqrt{2}$

(b) $6\sqrt{2}$

(c) $2\sqrt{2}$

(d) $8\sqrt{2}$

(e) $4\sqrt{2}$

60. A rectangular fence is made from two different materials. The sides that point North/South cost \$ 2 per foot, while the sides that point East/West cost \$8 per foot. Assuming the enclosed rectangle is to have an area of 100 square feet, what is the perimeter of the fence that minimizes the total cost?

(a) 30 feet

(b) 50 feet

(c) 25 feet

(d) 40 feet

(e) 35 feet

61. Determine $f(1)$ assuming $f'(t) = 20\mathrm{e}^t$ and $f(0) = 10$.

(a) e^{10}

(b) $\mathrm{e} - 10$

(c) $10\mathrm{e}$

(d) $20\mathrm{e} + 10$

(e) $20\mathrm{e} - 10$

62. Determine $f(2)$ assuming $f''(t) = 6t$, $f'(0) = 20$ and $f(0) = 5$.

(a) 56

(b) 55

(c) 54

(d) 53

(e) 52

63. Determine $f(\pi)$ assuming that $f''(t) = 2\cos(2t)$, $f'(0) = 1$ and $f(0) = 10$.

(a) 10

(b) π

(c) $10 + \pi$

(d) $10 - \pi$

(e) 10π

64. $\int \sqrt{2x+7}\ dx =$ ________

(a) $\frac{2}{3}(2x+7)^{3/2}+C$

(b) $\frac{1}{3}(2x+7)^{3/2}+C$

(c) $\frac{1}{3}(2x+7)^{1/2}+C$

(d) $\frac{2}{3}(2x+7)^{1/2}+C$

(e) $\frac{1}{3}(2x+7)^{-1/2}+C$

65. $\int \frac{x}{3x^2+4}\ dx =$ ________.

(a) $\ln(3x^2+4)+C$

(b) $\frac{1}{6(3x^2+4)^2}+C$

(c) $\frac{x}{3x^2+4}+C$

(d) $\frac{1}{6}\ln(3x^2+4)+C$

(e) $\frac{x^2/2}{x^3+4x}+C$

66. $\int 2\cos(\pi x)\ dx =$ ________

(a) $2\sin(\pi x)+C$

(b) $\frac{2\sin(\pi x)}{\pi}+C$

(c) $\frac{\pi\sin(\pi x)}{2}+C$

(d) $-\frac{\pi\sin(\pi x)}{2}+C$

(e) $-\frac{2\sin(\pi x)}{\pi}+C$

67. An object travels in a straight line with velocity function $v(t) = 3\sqrt{t}$ (miles per hour). Determine the net change position (in miles) over the time interval $4 \leq t \leq 9$.

(a) 34 miles

(b) 36 miles

(c) 38 miles

(d) 40 miles

(e) 42 miles

68. An object travels in a straight line with velocity function $v(t) = 4\cos(\pi t)$ (meters per second). Determine the net change in position (in meters) over the time interval $0 \le t \le 1$.

(a) -2 meters

(b) 2 meters

(c) -1 meter

(d) 1 meter

(e) 0 meters

69. An object travels in a straight line with acceleration function $a(t) = -10t$ (meters per second^2). Determine the net change in velocity over the time interval $1 \le t \le 3$.

(a) 40 m/sec

(b) -40 m/sec

(c) 0 m/sec

(d) -20 m/sec

(e) 20 m/sec

70. $\displaystyle\int_0^1 \frac{x}{x^2+1}\,dx =$ ________.

(a) $\ln 2$

(b) $\dfrac{\ln 2}{2}$

(c) 1

(d) $\dfrac{\ln 2}{3}$

(e) $\ln 3$

71. $\displaystyle\int_0^2 2\sin(\pi x)\,dx =$ ________.

(a) 0

(b) 1

(c) -1

(d) 2

(e) -2

72. $\int_0^1 xe^{x^2}\ dx =$ ________

(a) $\frac{e^2-1}{2}$

(b) $\frac{2e-1}{2}$

(c) $\frac{e-2}{2}$

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

(e) $\frac{e+1}{2}$

73. $\int_e^{10e} \frac{1}{x}\ dx =$ ________

(a) $-\ln(10e)$

(b) $\ln 10$

(c) $\ln(10e)$

(d) $-\ln 10$

(e) $\ln 10 + \ln e$

74. $\int_e^{e^2} \frac{1}{x}\ dx =$ ________.

(a) e

(b) 1

(c) e^2

(d) e^2-e

(e) 0

75. $\int_0^{\pi} \frac{\sin(x)}{2+\cos(x)}\ dx =$ ________.

(a) 1

(b) $\ln 3$

(c) $\ln 2$

(d) $\sin(e)$

(e) $2+\cos(e)$