1. (7.2) What is the value of $27^{\frac{1}{3}}$?

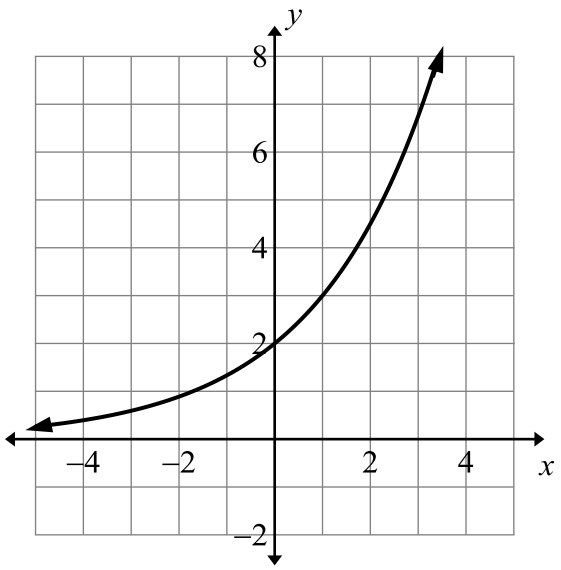
(A) $\frac{1}{9}$

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

(C) 9

(D) 3

2. (7.3) The graph shows an exponential function.



What is the equation of the function?

(A) $y = \left(\frac{2}{3}\right)^x$

(B) $y = 2(3)^x$

(C) $y = 2\left(\frac{3}{2}\right)^x$

3. (7.4) If $f(x)=2^x$, where is the y-intercept of $g(x)=f(x)+4$?

(A) $(0,4)$

(B) $(0,5)$

(C) $(0,1)$

(D) $(1,0)$

For questions 4-6, use the function $f(x)=2^x$.

4. (7.4) The *y*-intercept of $y=f(x)$ is (0, 1).

(A) True
(B) False

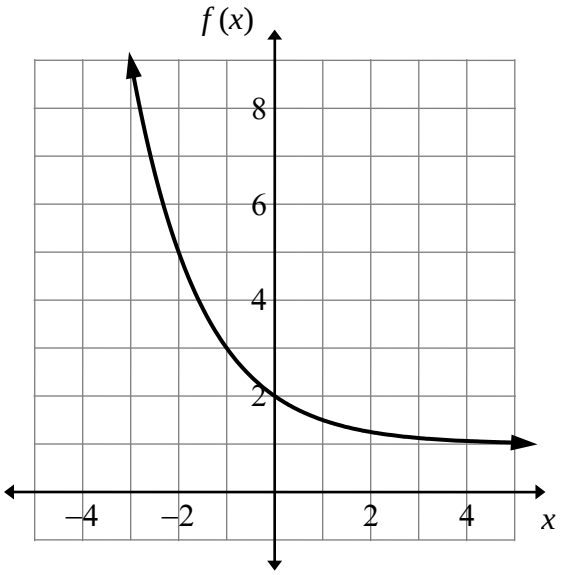
5. (7.4) The slope of $y=f(x)$ is equal for all values of *x*.

(A) True
(B) False

6. (7.4) There are no values of *x* for which $f(x)<0$.

(A) True
(B) False

7.(7.4) Use the graph.



What is the equation of the function?

(A) $f(x) = -\frac{1}{2}x + 2$

(B) $f(x) = -2x + 2$

(C) $f(x) = 2^x + 1$

(D) $f(x) = \left(\frac{1}{2}\right)^x + 1$

For questions 8-9, use this scenario.

The tuition at a private college can be modeled by the equation $T(y) = \$30,000(1.07)^y$, where y is the number of years since 2000.

8. (7.4) The tuition in the year 2000 was $30,000.

(A) True

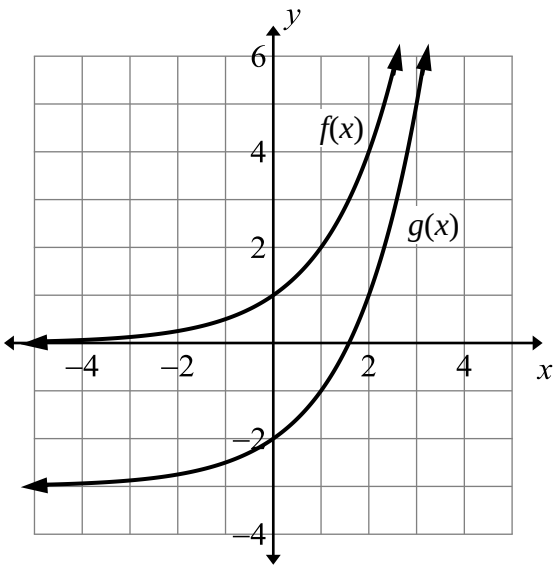
(B) False

9. (7.4) The growth rate of tuition is 107%.

(A) True

(B) False

10. (7.4) The graph shows two functions, f and g.



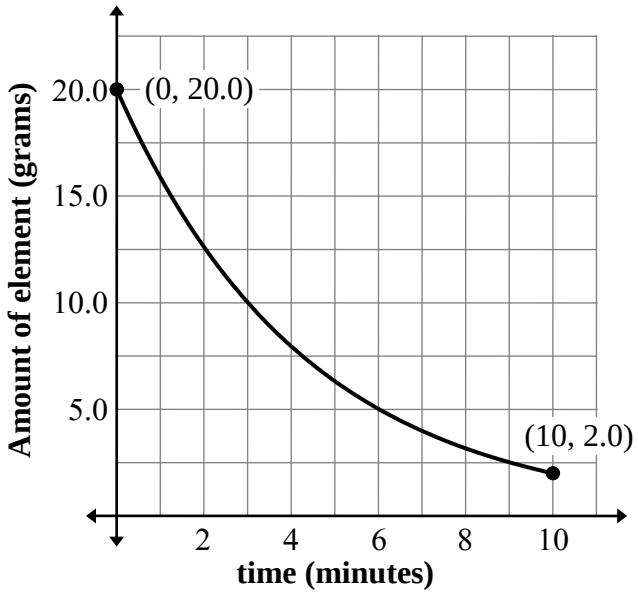
Which describes $g(x)$ in terms of $f(x)$?

(A) $g(x) = -2f(x)$

(B) $g(x) = f(x-3)$

(C) $g(x) = f(x)-3$

11. (7.5) The graph models the amount of a radioactive element present over the course of a 10-minute experiment.



What is the average rate of change of the amount of the element over the 10-minute experiment?

(A) –0.2 g/min

(B) –1.8 g/min

(C) –2.0 g/min

(D) –5.0 g/min

For questions 12-14, determine which expressions are equal to $(1+0.06)^t$.

12. (7.5)The growth rate is 6%?

(A) True

(B) False

13. (7.6) $1.06^t = (1+0.06)^t$

(A) True

(B) False

14. (7.6) $1+0.06^t = (1+0.06)^t$

    (A) True

    (B) False

15. (7.6) A student noticed that the value of $f(2)$ is 10% less than $f(1)$. He also noticed that $f(3)$ is 10% less than $f(2)$. Which is true?

    (A) f is a linear function with slope $\frac{1}{10}$.

    (B) f is a linear function with slope $\frac{9}{10}$.

    (C) f is an exponential function with base $\frac{1}{10}$.

    (D) f is an exponential function with base $\frac{9}{10}$.

16. (7.6) A population begins with 1,200 individuals and grows at a rate of 10% per year. Which function describes the population?

    (A) $P(x)=1200(1.1)^x$

    (B) $P(x)=1200(1.2)^x$

    (C) $P(x)=1320(1.1)^x$

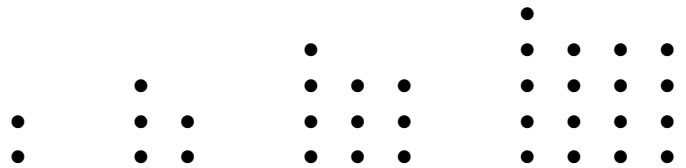
17. (7.8) Solve each equation for the variable indicated.

    (a) $3\cdot 2^x = 48$, for x.

    (b) $k^{3/2} = \sqrt[4]{k^n}$, for n.

    (c) $\left[(1+r)^{1/2}\right]^{2t} = (1+r)^6$, for t.

18. (7.8)Mark and Sofia are looking at this pattern of dots.



Mark says the number of dots in figure number *n* is equal to n^2+1.

Sofia says the number of dots in figure number *n* is equal to $n(n+1)-(n-1)$.

(a) Using the dot patterns, explain why each student is correct.

(b) Show algebraically that Mark's and Sofia's expressions are equivalent.

19. (7.11) Becky has one piece of paper. She cuts the paper in half and then has two pieces. She cuts these in half to get four pieces. The process continues. Which describes how many pieces she has at each step?

(A) $p(1)=1;\ p(n)=2p(n-1),\ \text{for}\ n\geq 2$

(B) $p(1)=1;\ p(n)=\frac{1}{2}p(n-1),\ \text{for}\ n\geq 2$

(C) $p(1)=1;\ p(n)=p(n-1)+1,\ \text{for}\ n\geq 2$

20. (7.11) Which recursive sequence is equivalent to $t(n)=4\left(\frac{2}{3}\right)^n$?

(A) $t(1)=4;\ t(n+1)=\frac{2}{3}t(n),\ \text{for}\ n\geq 1$

(B) $t(1)=\frac{8}{3};\ t(n+1)=\frac{2}{3}t(n),\ \text{for}\ n\geq 1$

(C) $t(1)=4;\ t(n+1)=\left(\frac{2}{3}\right)^{t(n)},\ \text{for}\ n\geq 1$

(D) $t(1)=\frac{8}{3};\ t(n)=\left(\frac{2}{3}\right)^{t(n)},\ \text{for}\ n\geq 1$

For questions 21-22, classify each number as rational or irrational.

21. (8.1) $-7+\sqrt{3}$

(A) rational

(B) irrational

22. (8.1) $2\frac{1}{3}+\frac{17}{2}$

(A) rational

(B) irrational

23. (8.1) Answer each part.

(a) What is an irrational number?

(b) Explain why $2+\sqrt{3}$ is an irrational number.

24. (8.2)The irrational numbers are closed under multiplication.

(A) True

(B) False

25. (8.2)In each part, provide an example of the statement.

(a) The sum of two rational numbers is rational.

(b) The product of a rational number and an irrational number is irrational.

(c) The product of two irrational numbers can be rational.

26. (8.2)Answer each part.

(a) Write $\sqrt{24}$ as the product of a rational and an irrational number.

(b) Give an example where the product of two irrational numbers is a rational number.

(c) Explain why the sum of a rational number and an irrational number must be irrational.

27. (8.3)Which is equivalent to $\sqrt{18x^2y^3}$ where $x > 0$ and $y > 0$?

(A) $9xy\sqrt{y}$

(B) $3xy\sqrt{2y}$

(C) $3x^2y^2\sqrt{2y}$

(D) $9x^2y^2\sqrt{y}$

28. (8.3)Which is equivalent to $\sqrt{\frac{64}{100}}$?

(A) $\frac{32}{10}$

(B) $\frac{32}{50}$

(C) $\frac{8}{10}$

(D) $\frac{8}{100}$

29. (8.3)Which is equivalent to $\sqrt{6}\sqrt{8}$?

(A) $4\sqrt{3}$

(B) $8\sqrt{3}$

(C) 12

(D) 24

30. (8.3)Which is equivalent to $\frac{\sqrt{27}}{\sqrt{36}}$?

(A) $\frac{3}{4}$

(B) $\frac{\sqrt{3}}{4}$

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

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

31. (8.3)Which is equivalent to $\sqrt{24}$?

(A) $8\sqrt{3}$

(B) $2\sqrt{6}$

(C) $6\sqrt{2}$

(D) $2\sqrt{12}$

32. (8.3)Which is equivalent to $\sqrt{xy}\sqrt{x^3y^5}$?

(A) x^2y^3

(B) x^4y^6

(C) $xy^2\sqrt{xy}$

(D) $x^2y^4\sqrt{xy}$

33. (8.3)Which is equivalent to $\sqrt{\frac{120}{3}}$?

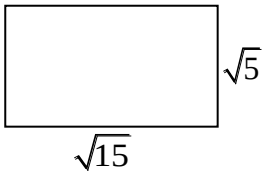
(A) $2\sqrt{10}$

(B) $4\sqrt{10}$

(C) $10\sqrt{2}$

(D) $10\sqrt{4}$

34. (8.3)A class of students was told to compute the area of the rectangle below.



The class came up with three different values for the area:

$2\sqrt{5}$ $5\sqrt{3}$ $\sqrt{75}$

How many of those values correctly represent the area of the rectangle?

(A) 0
(B) 1
(C) 2
(D) 3

35. (8.4) Which is equivalent to $y^{\frac{2}{3}}$?

(A) $2\sqrt[3]{y}$
(B) $3\sqrt{y}$
(C) $\sqrt[3]{y^2}$
(D) $\sqrt{y^3}$

36. (8.4) What is the value of n when $16^n = 2$?

(A) $\frac{1}{8}$
(B) $\frac{1}{4}$
(C) $\frac{1}{2}$

37. (8.5) If $p^2 = 25$ and $q^2 = 16$, which of these CANNOT equal $p + q$?

(A) –1
(B) 9
(C) 41

For questions 38-39, use the equation $x^2 = (2x + p)^2$.

38. (8.6) $x = 2x + p$

(A) True
(B) False

39. (8.6) $x = -(2x + p)$

(A) True
(B) False

40. (8.6)Solve the equation $\frac{u^2}{2} + P = h$ for u, where all variables are positive real numbers.

(A) $u = \sqrt{2h - P}$
(B) $u = \sqrt{\frac{h - P}{2}}$
(C) $u = \sqrt{2(h - P)}$
(D) $u = \sqrt{\frac{h}{2} - P}$

41. (8.6) Solve the equation for *x*:

$a(x-h)^2+k=p$

(A) $x=h\pm\sqrt{\frac{p}{a}-k}$

(B) $x=h\pm\sqrt{\frac{p}{a}}-\sqrt{k}$

(C) $x=h\pm\frac{\sqrt{p-k}}{a}$

(D) $x=h\pm\sqrt{\frac{p-k}{a}}$

42. (8.6)The equation $x^2=a$ has no real solutions. What must be true?

(A) $a<0$

(B) $a=0$

(C) $a>0$

43. (8.6)What is the solution set of the equation $4(t-3)^2-1=8$?

(A) $\left\{1\frac{1}{2}, 4\frac{1}{2}\right\}$

(B) $\left\{\frac{3}{4}, 5\frac{1}{4}\right\}$

(C) $\left\{3-\sqrt{3}, 3+\sqrt{3}\right\}$

(D) $\left\{3-\sqrt{5}, 3+\sqrt{5}\right\}$

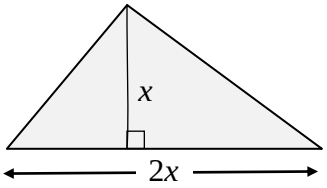
44. (8.6)Solve each quadratic equation for *x*.

(a) $x^2-8=0$

(b) $(x-2)^2-4=0$

(c) $3(x+6)^2=15$

45. (8.6)The area of the triangle below is 24 square units. What is the height of the triangle?



(A) 6 units

(B) 12 units

(C) $\sqrt{12}$ units

(D) $\sqrt{24}$ units

46. (9.1) Which expression is equivalent to $6x^2-4x+3-5-8x^2+7x$?

(A) $-2x^2+3x-2$

(B) $-2x^2+11x-2$

(C) $14x^2+3x+8$

(D) $14x^2+11x+8$

47. (9.2) What expression must the center cell of the table contain so that the sums of each row, each column, and each diagonal are equivalent?

$5x^2+x-9$	$-x^2-x-4$	$2x^2+3x-2$
$-x^2+3x+2$		$5x^2-x-12$
$2x^2-x-8$	$5x^2+3x-6$	$-x^2+x-1$

(A) $2x^2+x-5$

(B) $4x^2+2x-10$

(C) $6x^2+3x-15$

48. (9.2) Subtract:

$$\left(9y^2-5y+6\right)-\left(3y^2+y-4\right)$$

(A) $6y^2-4y+2$

(B) $6y^2-4y+10$

(C) $6y^2+6y+2$

(D) $6y^2-6y+10$

For questions 49-51, answer each with respect to the system of polynomials.

49. (9.2)The system of polynomials is closed under subtraction.

(A) True

(B) False

50. (9.3)The system of polynomials is closed under division.

(A) True

(B) False

51. (9.3)The system of polynomials is closed under multiplication.

(A) True

(B) False

52. (9.3) Answer each part.

a) Define "polynomial" and give two examples.

b) Give an example where the sum of two binomials is a trinomial.

c) When two polynomials are multiplied, the result must be a polynomial. Explain why this is true.

53. (9.3) Under what operations is the system of polynomials NOT closed?

(A) addition
(B) subtraction
(C) multiplication
(D) division

54. (9.3)Which expression is equivalent to $xc + xb + yc + yb$?

(A) $(x+b)(y+c)$
(B) $(x+c)(y+b)$
(C) $(x+y)(b+c)$

55. (9.3) Let $x^2 + y^2 = 23$ and $xy = 6$. What is the value of $(x+y)^2$?

(A) 9
(B) 23
(C) 29
(D) 35

56. (9.3) Which is equivalent to $3x\left(x^2y + 2xy^2\right)$?

(A) $3x^2y + 6xy^3$
(B) $3x^3y + 2xy^2$
(C) $3x^3y + 6x^2y^2$
(D) $9x^4y^3$

57. (9.3) Expand the expression $(3x-7)^2$.

(A) $9x^2 - 42x - 49$
(B) $9x^2 - 42x + 49$
(C) $9x^2 - 49$
(D) $9x^2 + 49$

58. (9.3) Given $ax^2+bx+c=2(1.2x+0.3)(x-0.5)+(0.5x^2+2.5x-1.3)$.
What are the values of *a*, *b*, and *c*?

59. (9.3)Given $f(x)=2x-3$, $g(x)=\frac{x}{3}+2$, and $h(x)=3x^2-x-4$, find:

(a) $f(x)\cdot g(x)$

(b) $f(x)+h(x)$

(c) $f(x)-g(x)$

60. (9.4)Which is equivalent to $(4x^2-9y^4)$

(A) $(2x-3y^2)^2$

(B) $(2x-3y^2)(2x+3y^2)$

(C) $(2x+3y^2)(2x-3y)(2x+3y)$

For questions 61-63, use the expression x^4-y^4.

61. (9.4) $(x^2-y^2)(x^2+y^2)$ is equivalent to the given expression.

(A) True
(B) False

62. (9.4) $(x-y)(x+y)(x^2+y^2)$ is equivalent to the given expression.

(A) True
(B) False

63. (9.4) $(x-y)(x+y)^3$ is equivalent to the given expression.

(A) True
(B) False

64. (9.4)Which of these is NOT a factor of $12x^2+6x-90$?

(A) 6

(B) $2x$

(C) $x+3$

(D) $2x-5$

65. (9.4) If $(x-7)$ is a factor of $2x^2-11x+k$, what is the value of *k*?

(A) –21

(B) –7

(C) 7

(D) 28

66. (9.4) Factor $25x^2+4$.

(A) $(5x+2)(5x-2)$

(B) $(5x+2)^2$

(C) The expression is not factorable with real coefficients.

67. (9.4) Factor $9x^2-16$.

(A) $(3x+4)(3x-4)$

(B) $(3x-4)^2$

(C) The expression is not factorable with real coefficients.

68. (9.4) Which is a factor of $4x^2-6x-40$?

(A) $2x+5$

(B) $2x-5$

(C) $2x+4$

(D) $2x-4$

69. (9.4)Which expression is equivalent to $x^2+3x-40$?

(A) $(x-5)(x+8)$

(B) $(x-5)(x-8)$

(C) $(x+5)(x+8)$

(D) $(x+5)(x-8)$

70. (9.4)Which expression is equivalent to $35x^2+26x-16$?

(A) $(7x-2)(5x+8)$

(B) $(7x+2)(5x-8)$

(C) $(7x-8)(5x+2)$

(D) $(7x+8)(5x-2)$

71. (9.4)What value of *c* makes the expression y^2-9y+c a perfect trinomial square?

(A) –9

(B) $-\frac{9}{2}$

(C) 81

(D) $\frac{81}{4}$

For questions 72-74, consider the solutions to the equation $(x+5)(x-3)=0$.

72. (9.5) $x^2-15=0$ has the same solutions as the given equation.

(A) True

(B) False

73. (9.5) $x^2+2x-15=0$ has the same solutions as the given equation.

(A) True

(B) False

74. (9.5) $(x+1)^2-14=0$ has the same solutions as the given equation.

(A) True

(B) False

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75. (9.5) The expression $4x^2+bx-3$ is factorable into two binomials. Which could NOT equal b?

(A) -7

(B) -1

(C) 1

(D) 11

76. (9.5) Which quadratic equation has solutions of $x = 2a$ and $x = -b$?

(A) $x^2-2ab=0$

(B) $x^2-x(b-2a)-2ab=0$

(C) $x^2-x(b+2a)+2ab=0$

(D) $x^2+x(b-2a)-2ab=0$

77. (9.5) Which equation has roots of 4 and -6?

(A) $(x-4)(x+6)=0$

(B) $(x-4)(x-6)=0$

(C) $(x+4)(x+6)=0$

(D) $(x+4)(x-6)=0$

78. (9.5) What value(s) of x make the equation $(x-m)(x-n)=0$ true? (m and n do not equal zero.)

(A) $-m$ and $-n$

(B) m and n

(C) mn

(D) 0

79. (9.5)Solve the quadratic $4x^2=14x+8$.

(A) $x = -2$ or $x = 1$

(B) $x = -\frac{1}{2}$ or $x = 4$

(C) $x = -\frac{1}{7}$ or $x = 8$

(D) $x = 0$ or $x = -\frac{7}{4}$

80. (9.5) When $2x^2+(4-p)x-2p=0$, $x = -2$ is a solution. Which is a factor of $2x^2+(4-p)x-2p$?

(A) $2x-p$

(B) $2x+p$

(C) $4-p$

(D) $x-2p$

81. (9.6) Given $4x^2+28x+c=(2x+q)^2$, where c and q are integers, what is the value of c?

(A) 2

(B) 7

(C) 14

(D) 49

82. (9.6) The quadratic equation $2x^2 - 16x - 15 = 0$ is rewritten as $(x - p)^2 = q$. What is the value of q?

(A) $\frac{47}{2}$

(B) $\frac{15}{2}$

(C) $\frac{143}{2}$

83. (9.6)What number should be added to both sides of the equation to complete the square in $x^2 + 8x = 17$?

(A) 4

(B) 16

(C) 29

(D) 49

84. (9.6)Find all solutions to the equation $x^2 - 10x + 25 = 81$. Show your work.

85. (9.7)The distance traveled by a dropped object (ignoring air resistance) equals $\frac{1}{2}gt^2$, where g is the acceleration of the object due to gravity and t is the time since it was dropped. If acceleration due to gravity is about 10 m/s^2, how much time does it take an object to fall 80 meters?

(A) about 3 seconds

(B) about 4 seconds

(C) about 5.5 seconds

(D) about 9 seconds

For question 86, the quadratic equation $f(x) = 2x^2 - 3x + c = 0$ has exactly one real solution.

86. (9.7-4) $c = \frac{9}{8}$

(A) True

(B) False

87. (9.7)How many real solutions does the equation $x^2+4=0$ have?

(A) 0

(B) 1

(C) 2

88. (9.7)How many real solutions does the equation $3y^2=0$ have?

(A) 0
(B) 1
(C) 2

89. (9.7)Which shows the correct use of the quadratic formula to find the solutions of $8x^2+2x=1$?

(A) $x=\dfrac{2\pm\sqrt{(2)^2-4(8)(1)}}{2(8)}$

(B) $x=\dfrac{2\pm\sqrt{(2)^2-4(8)(-1)}}{2(8)}$

(C) $x=\dfrac{-2\pm\sqrt{(2)^2-4(8)(1)}}{2(8)}$

(D) $x=\dfrac{-2\pm\sqrt{(2)^2-4(8)(-1)}}{2(8)}$

90. (9.7) A quadratic expression has two factors. One factor is $(2x-3)$.

In each part below, find another factor of the quadratic, if possible. If the situation described is not possible, explain why.

a) The quadratic has no real zeros.
b) The quadratic has only one real zero.
c) The quadratic has two distinct real zeros.

91. (9.7)One way of expressing a quadratic function is $f(x)=ax^2+bx+c$. A second way is $f(x)=a(x-h)^2+k$.

a) Find *b* in terms of *a*, *h*, and *k*.
b) Find *c* in terms of *a*, *h*, and *k*.

92. (9.7) Which value of *x* is a solution to the equation $x^2-3x-3=-\frac{3}{5}x+\frac{3}{2}$?

(A) $x \approx -0.68$
(B) $x \approx -1.24$
(C) $x \approx 2.50$
(D) $x \approx 3.79$

93. (9.7) Given $f(x)=x^2-2x+9$.

a) Complete the square for $f(x)$.

b) Using the quadratic formula, explain why the graph of $y=f(x)$ has no *x*-intercepts.

For question 94, the quadratic equation $f(x)=2x^2-3x+c=0$ has exactly one real solution.

94. (9.8) $f(x)$ can be written as a difference of squares.
(A) True
(B) False

95. (9.8) What is the solution set of $-4x^2=5x+9$?

(A) $\left\{-1, -\frac{1}{4}\right\}$
(B) $\left\{-1, \frac{9}{4}\right\}$
(C) $\left\{\frac{-5+\sqrt{119}}{4}, \frac{-5-\sqrt{119}}{4}\right\}$
(D) There are no real solutions.

96. (9.8) What is the solution set for the equation $x^2+8x+16=49$?

(A) $\{4, 7\}$

(B) $\{-7, -4\}$

(C) $\{-11, 3\}$

(D) $\{-3, 11\}$

97. (9.8) What are the solutions of $3x^2-6x=-2$?

(A) $x=\frac{1\pm\sqrt{3}}{3}$

(B) $x=\frac{-1\pm\sqrt{3}}{3}$

(C) $x=1\pm\frac{\sqrt{3}}{3}$

(D) $x=-1\pm\frac{\sqrt{3}}{3}$

98. (9.8) What is the solution set of the equation $36x^2-25=0$?

(A) $\left\{\frac{5}{6}\right\}$

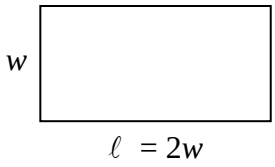
(B) $\left\{\frac{25}{36}\right\}$

(C) $\left\{\frac{-5}{6}, \frac{5}{6}\right\}$

(D) $\left\{\frac{-25}{36}, \frac{25}{36}\right\}$

For questions 99-100, use the scenario below.

A rectangular playground is built such that its length is twice its width.



99. (9.9)The area of the playground can be expressed as $2w^2$.

(A) True

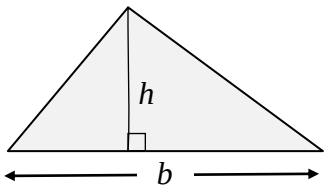
(B) False

100. (9.9) The perimeter of the playground can be expressed as $4w^4$.

(A) True

(B) False

101. (9.9) Use the figure below.



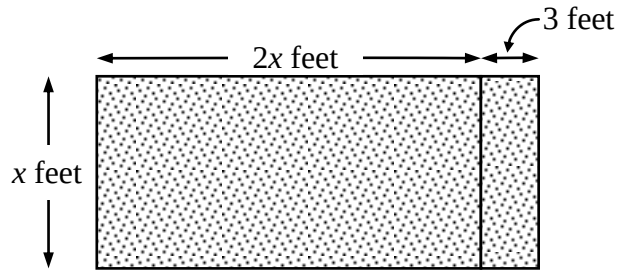
The length of the triangle's base *b* is twice its height *h*.

(a) What are the approximate lengths of the base and height when the triangle's area is 25 m^2?

(b) A <u>similar</u> triangle has a height whose measure (in feet) is a positive integer. What could its area be?

102. (9.9) The braking distance *d*, in feet, for a car can be modeled by $d = \frac{3\left(s^2 + 10s\right)}{40}$. where *s* is the speed of the car in miles per hour. What is the fastest speed that a car can be moving so that braking distance does not exceed 150 feet? Show your work.

103. (9.9) The figure below shows a proposed sand pit, an area in a park that will be filled with sand.



The sand pit is to be a large rectangular area twice as long as it is wide, plus a smaller rectangular area 3 feet long and as wide as the large area. The two areas share a common side.

(a) Write an expression for the total perimeter of the sand pit as a function of x.

(b) Write an expression for the total area of the sand pit as a function of x.

(c) The sand in the pit is to be 3 inches deep throughout. The park has 40 cubic feet of sand available. What will be the approximate dimensions of the sand pit?

(d) The pit is to be bordered by a chain link fence. How much fencing is needed?

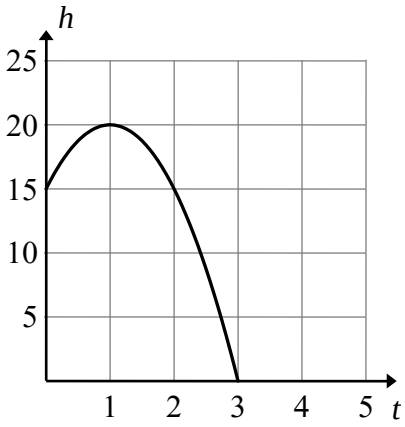
104. (9.9) A farmer can grow about 10,000 bushels of soybeans on a plot of land 1 kilometer by 1 kilometer.

(a) Write a function that shows how many bushels of soybeans the farmer can grow on a plot of land x kilometers by x kilometers.

(b) The price per bushel is p dollars per bushel. Write a function that shows how much money can be earned from a plot of land x kilometers by x kilometers.

(c) Last year, a farmer sold \$960,000 of soybeans at \$15/bushel. What would be the dimensions of a square field that produced this sale of soybeans?

In questions 105-107, use the graph below. The graph shows the height *h* above the ground (in meters) of a thrown ball as a function of time (in seconds).



105. (9.9) The ball hits the ground 3 seconds after it is thrown.

(A) True

(B) False

106. (9.9) Height begins decreasing as soon as the ball is thrown ($t = 0$).

(A) True

(B) False

107. (9.9) The domain of the function that describes the height of the ball is all real numbers.

(A) True

(B) False

108. (9.9) A scientist drops an object from the top of and 80-foot building. The scientist uses a stopwatch to measure the time between when it was dropped and when it hits the ground. The height of the object above ground as a function of time is given by $h(t) = 80 - 16t^2$. Which is the domain of this function?

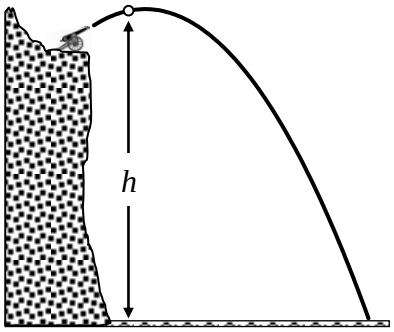
(A) t can be any real number.

(B) t can be any positive real number.

(C) t can be any real number between 0 and 80, inclusive.

(D) t can be any real number between 0 and $\sqrt{5}$, inclusive.

In questions 109-111, use the diagram and scenario below.



A cannonball is shot from the top of an ocean cliff as shown. The height (in meters) of the cannonball above the water is given by $h(t) = -5t^2 + 15t + 8$, where t is the number of seconds after the shot.

109. (9.9) The cannon is 8 meters above the water.

(A) True

(B) False

110. (9.9) The cannonball reaches its maximum height at 1.5 seconds after it is shot.

(A) True

(B) False

111. (9.9) The cannonball hits the water 8 seconds after it is shot.

(A) True

(B) False

112. (9.9) A company produces toy trains. The cost C of producing t trains is given by the equation $C = 300 + 15t$. Which shows the number of trains that can be produced for a given cost?

(A) $t = -300 + 15C$

(B) $t = 300 - 15C$

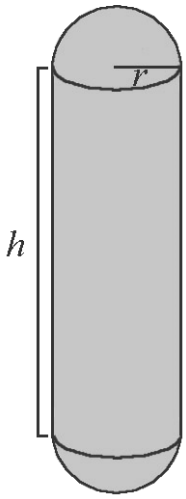
(C) $t = -300 + \frac{1}{15}C$

(D) $t = -20 + \frac{1}{15}C$

113. (9.9)The surface area of a hemisphere with radius *r* is given by $A_H = 2\pi r^2$.

The lateral surface area of a cylinder with radius *r* and height *h* is given by $A_L = 2\pi rh$.

A "capsule" is composed of two hemispheres attached to a cylinder with a common radius. In this capsule, the height of the cylinder is 7 times its radius.



(a) Create a function $C(r)$ that describes the surface area of the capsule.

(b) What is the radius of a capsule with a surface area of 2.3 cm^2?

114. (10.1) The graph of $y = x^2 - 3x + 6$ has how many *x*-intercepts?

(A) 0

(B) 1

(C) 2

(D) 6

115. (10.1) Which quadratic function's graph is symmetric about the line $x = 3$?

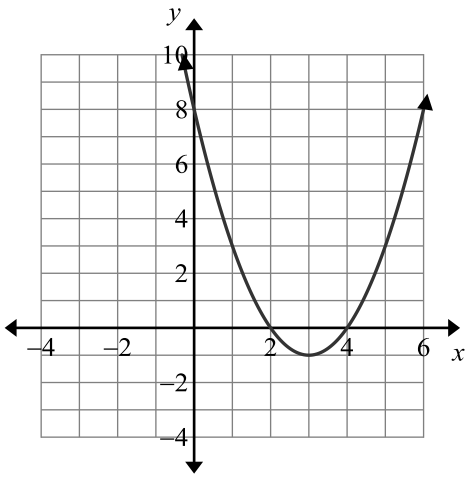
(A) $y = x^2 - 6x + 2$

(B) $y = 3x^2 + x - 7$

(C) $y = x^2 - 3x + 5$

(D) $y = 2x^2 + 12x - 1$

116. (10.1) What are the domain and range of the function $y = x^2 - 6x + 8$ shown in the graph below?



(A) Domain: all real numbers
Range: $y \geq -1$

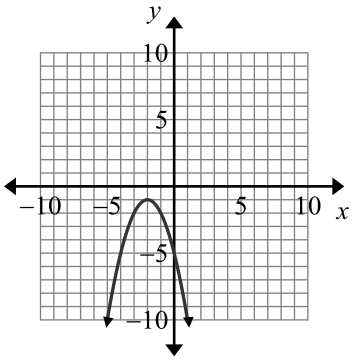
(B) Domain: all real numbers
Range: all real numbers

(C) Domain: $2 \leq x \leq 4$
Range: $y \geq -1$

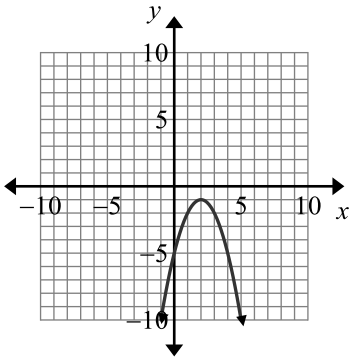
(D) Domain: $2 \leq x \leq 4$
Range: all real numbers

117. (10.1) Which of the following is the graph of $y = -x^2 + 4x - 5$?

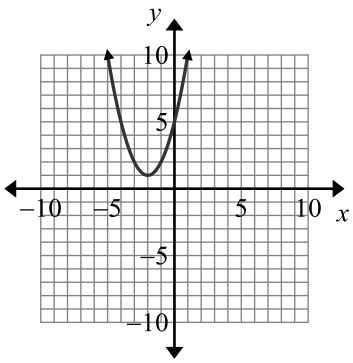
(A)



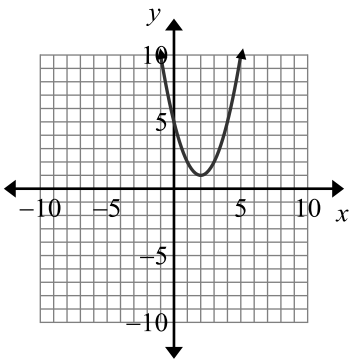
(B)



(C)

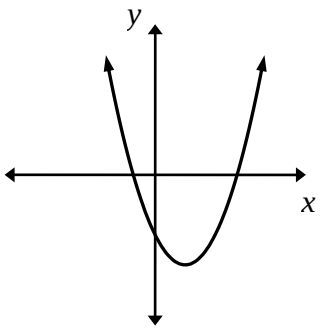


(D)

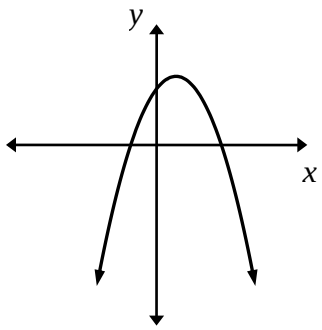


118. (10.1) A quadratic function is given by $h(x) = ax^2 + bx + c$, where a and c are negative real numbers. Which of these could be the graph of $y = h(x)$?

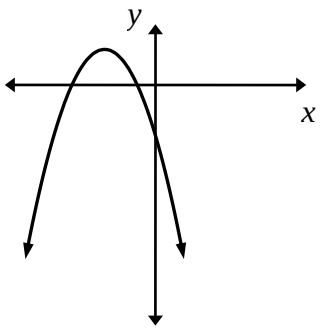
(A)



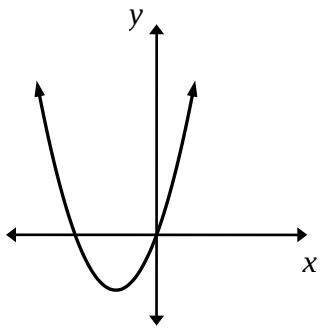
(B)



(C)

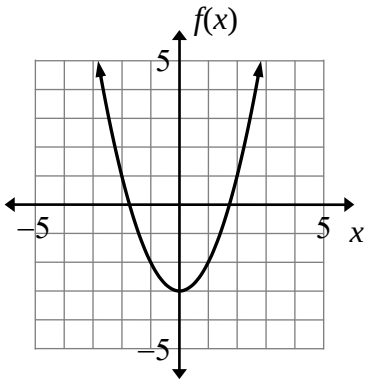


(D)

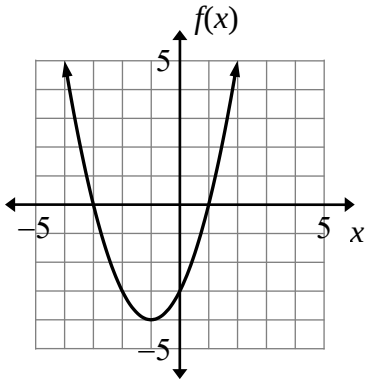


119. (10.1) Which is the graph of $f(x) = x^2 + 2x - 3$?

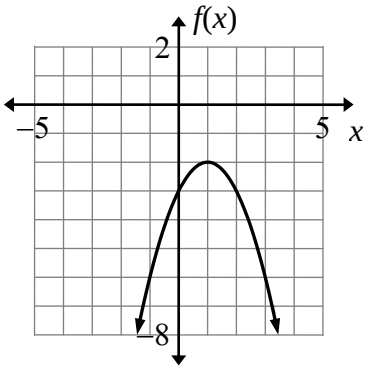
(A)



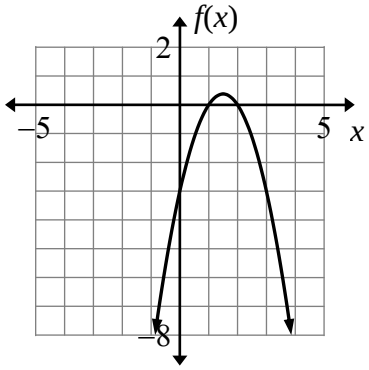
(B)



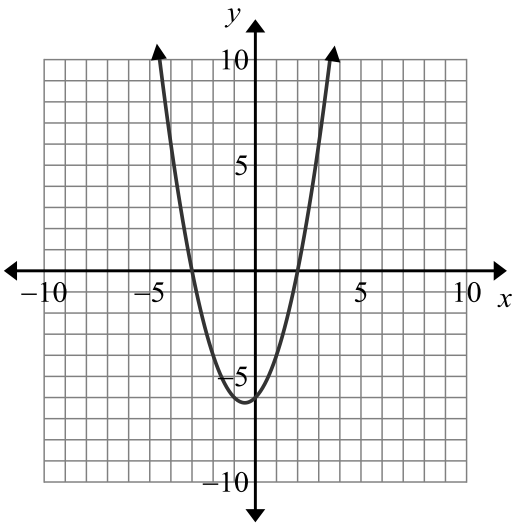
(C)



(D)



120. (10.1) Use the graph.



Which equation is represented the following graph?

(A) $y = x^2 - x - 6$

(B) $y = x^2 - x + 6$

(C) $y = x^2 + x - 6$

(D) $y = x^2 + x + 6$

For questions 121-122, consider the graph of $y = 4x^2 - 5x - 4$.

121. (10.1) The graph opens up.

(A) True

(B) False

122. (10.1) The axis of symmetry is at $x = -\frac{5}{8}$.

(A) True

(B) False

123. (10.1) What is the vertex of the parabola in the given equation?

$y = -3x^2 + 12x - 5$

(A) $(-2, -41)$

(B) $(2, 7)$

(C) $(2, 55)$

(D) $(6, -41)$

124. (10.1) The table below is of the quadratic $f(x)$.

x	–3	–2	–1	0	1	2
$f(x)$	0	–9	–12	–9	0	15

A second quadratic is defined as $g(x) = x^2 - 6x - 5$.

Which is true about the two functions' minimum values?

(A) $f(x)$ has a smaller minimum value.

(B) $g(x)$ has a smaller minimum value.

(C) The minimum values of $f(x)$ and $g(x)$ are equal.

(D) Which function has the smaller minimum cannot be determined from the information given.

125. (10.1) Use the function $f(x) = -2x^2 - 2x + 1$.

Show all work.

(a) Identify the intercepts.
(b) Identify the axis of symmetry.
(c) Determine the coordinates of the vertex.
(d) Sketch the graph.
(e) State the domain and range.

126. (10.2) Where is the axis of symmetry in the quadratic $f(x)=3(x-9)(x+5)$?

(A) $x = 4$
(B) $x = 2$
(C) $x = 6$
(D) $x = -2$

In questions 127-128, consider a quadratic $y = f(x)$ that has x-intercepts at $(r, 0)$ and $(s, 0)$, and a y-intercept at $(0, c)$.

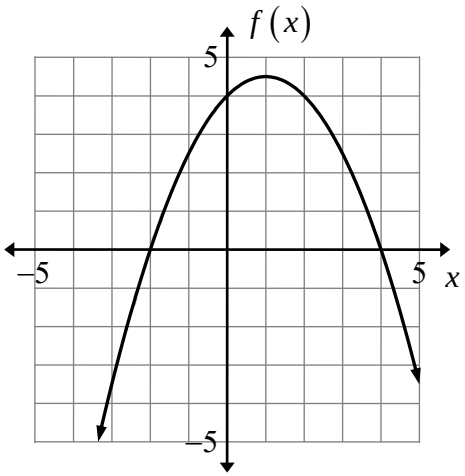
127. (10.2) The function $y = f(x)$ has an axis of symmetry at $x = \frac{r+s}{2}$.

(A) True
(B) False

128. (10.2) The function $y = f(x+2)$ has x-intercepts at $(r + 2, 0)$ and $(s + 2, 0)$.

(A) True
(B) False

129. (10.2) Look at the graph of the quadratic $f(x)$ below.



The graph of $g(x) = 3x^2 + bx - 24$ has the same *x*-intercepts.

What is the value of *b*?

(A) –6

(B) –2

(C) 1

(D) 14

130. (10.3) A quadratic function is defined as $y = (x+4)^2 - 7$. Which statement is true?

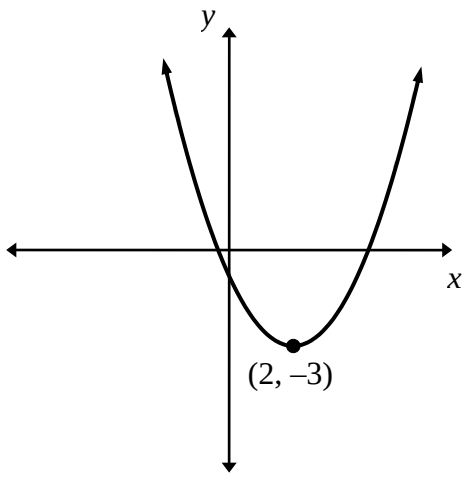
(A) The parabola has a <u>maximum</u> value of –7.

(B) The parabola has a <u>minimum</u> value of –7.

(C) The parabola has a <u>maximum</u> value of –4.

(D) The parabola has a <u>minimum</u> value of –4.

131. (10.3) Use the graph below.



Which equation could define the given parabola, where a is a positive real number?

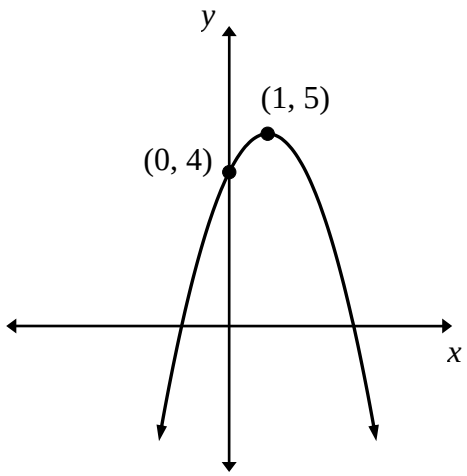
(A) $f(x) = a(x-2)^2 - 3$

(B) $f(x) = a(x+2)^2 - 3$

(C) $f(x) = a(x-2)^2 + 3$

(D) $f(x) = a(x+2)^2 + 3$

132. (10.3) Use the graph below.



(a) What is the equation of the function shown?
(b) Find the *x*-intercepts of the function.
(c) What is the average rate of change of the function between the two points identified on the graph?

133. (10.4) Define and sketch the three quadratic functions that have the following characteristics.

(a) *f* has an axis of symmetry at $x = 2$ and no *x*-intercepts.
(b) *g* has a *y*-intercept at 3 and opens downward.
(c) *h* has a zero at $x = -2$ and a minimum value of –6.

134. (10.4) A parabola is defined as $f(x) = a(x-3)^2 + 10$, where *a* is a positive real number. As *a* increases, what happens to the *y*-coordinate of the parabola's vertex?

(A) it decreases
(B) it increases
(C) it does not change

135. (10.4) A parabola is defined as $f(x) = a(x-3)^2 + 10$, where *a* is a positive real number. As *a* increases, what happens to the *y*-coordinate of the parabola's *y*-intercept?

(A) it decreases
(B) it increases
(C) it does not change

136. (10.4) The table below is of a quadratic function, $g(x)$, where x is measured in seconds and $g(x)$ is measured in meters.

x	0	1	2	3	4
$g(x)$	2.3	–1.0	1.7	10.4	25.1

What is the approximate rate of change over the interval $0 \le x \le 4$?

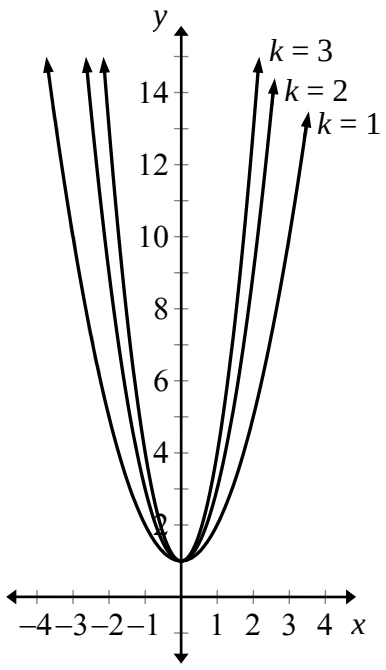
(A) 22.8 m/s

(B) 8.7 m/s

(C) 6.3 m/s

(D) 5.7 m/s

137. (10.4) Use the graph.



Which equation defines this set of parabolas?

(A) $y = kx^2 + 1$

(B) $y = \frac{1}{k}x^2 + 1$

(C) $y = x^2 + k$

In questions 138-139, consider a quadratic $y = f(x)$ that has x-intercepts at $(r, 0)$ and $(s, 0)$, and a y-intercept at $(0, c)$.

138. (10.4) The function $y = f(x) - 2$ has a y-intercept at $(0, c - 2)$.

(A) True
(B) False

139. (10.4) If $y = f(x)$ opens upward, then $y = -f(x)$ opens downward.

(A) True
(B) False

140. (10.5) Answer each part.

(a) Factor completely: $2x^2 + 4x - 16$

(b) Solve: $2x^2 + 4x - 16 = 0$

(c) Graph $f(x) = 2x^2 + 4x - 16$, and label key points and the axis of symmetry.

(d) Solve the system $y = f(x)$ and $y = -2x - 8$.

141. (10.6) Solve the system of equations.

$$\begin{cases} y = (x+4)^2 - 6 \\ -2x + y = 5 \end{cases}$$

(A) $(-4, 6)$
(B) $(0, 5)$
(C) $(-5, -5)$ and $(-1, 3)$
(D) $(-5, -5)$

For questions 142-143, use the table below.

x	–4	–3	–2	–1	0	1
$f(x)$	–23	–10	–3	–2	–7	–18
$g(x)$	–13	–11.5	–10	–8.5	–7	–5.5

142. (10.6) $f(x) = g(x)$ at $(0, -7)$.

(A) True

(B) False

143. (10.6) $f(x) = g(x)$ somewhere on the interval $-3 < x < -2$.

(A) True

(B) False

144. (10.6) The parabola $y = x^2 - 9$ and the line $y = -8x$ intersect at two points. Which equation would be useful to find these points?

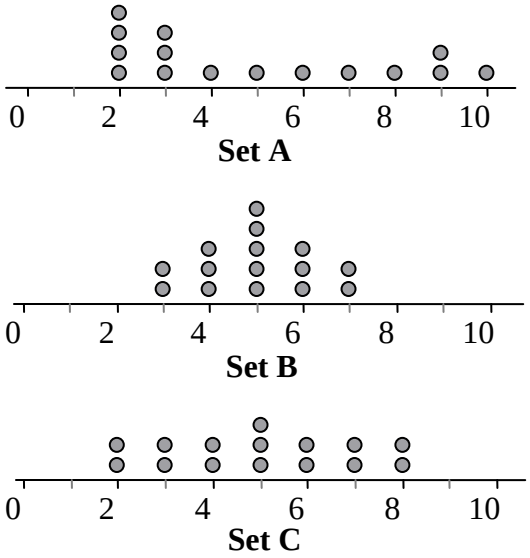
(A) $(-8x)^2 - 9 = 0$

(B) $-8(x^2 - 9) = 0$

(C) $x^2 + 8x - 9 = 0$

(D) $x^2 - 8x - 9 = 0$

145. (11.1) Examine the dotplots below from three sets of data.



The mean of each set is 5. The standard deviations of the sets are 1.3, 2.0, and 2.9. Match each data set with its standard deviation.

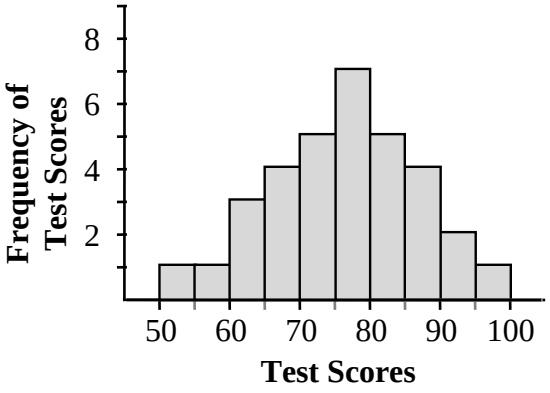
(A) Set A: 1.3 Set B: 2.0 Set C: 2.9

(B) Set A: 2.0 Set B: 1.3 Set C: 2.9

(C) Set A: 2.0 Set B: 2.9 Set C: 1.3

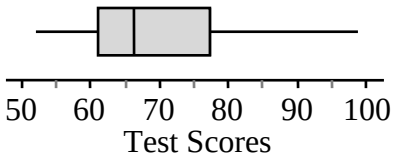
(D) Set A: 2.9 Set B: 1.3 Set C: 2.0

146. (11.2) Mrs. Johnson created this histogram of her 3rd period students' test scores.

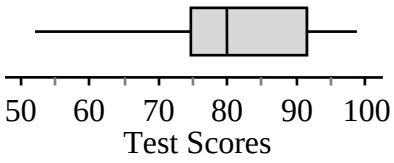


Which boxplot represents the same information as the histogram?

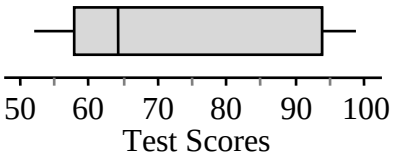
(A)



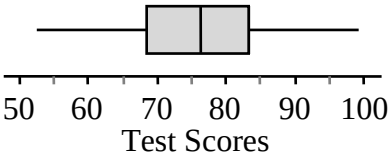
(B)



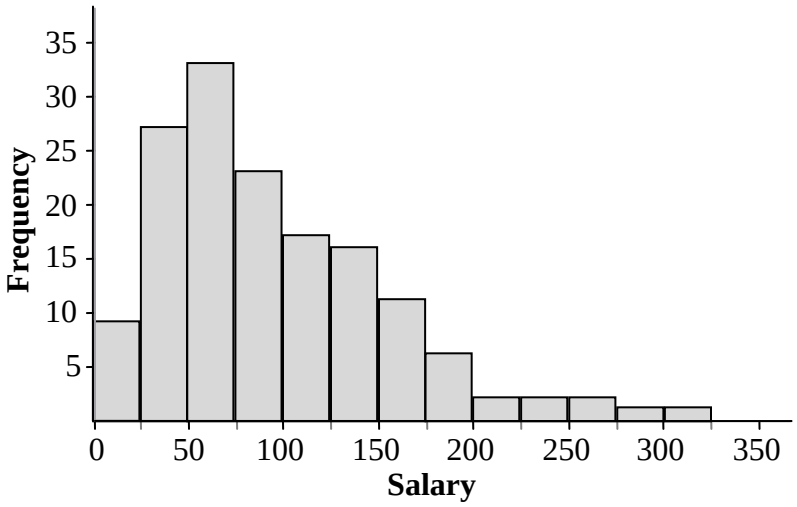
(C)



(D)



147. (11.2) This graph shows annual salaries (in thousands of dollars) for all workers in a certain city.



The median salary is $80,500. Which value is the best approximation for the mean?

(A) $66,500
(B) $80,500
(C) $94,500

For questions 148-149, use the following scenario.

A survey was made of high-school-aged students owning cell phones with text messaging. The survey asked how many text messages each student sends and receives per day. Some results are shown in the table below.

		Number of text messages sent/received per day among teens who text	
Group	Number Surveyed	Mean	Median
Girls, 14–17 years old	270	187	100
Boys, 14–17 years old	282	176	50
Total	552		

148. (11.2) A histogram of the girls' responses (not shown) has a strong right skew. Which statement would support that observation?

(A) The number of girls' surveyed is greater than the mean number of texts sent by girls.
(B) The mean number of texts sent by girls is greater than the median number of texts sent by girls.
(C) The mean number of texts sent by girls is greater than the mean number of texts sent by boys.
(D) The median number of texts sent by girls is greater than the median number of texts sent by boys.

149. (11.2) Which expression shows the mean number of text messages for all girls and boys, 14–17 years old?

(A) $\frac{187+176}{2}$

(B) $\frac{187+176}{552}$

(C) $\frac{270\times187+282\times176}{552}$

(D) It cannot be computed from the information given.

150. (11.2) Which group's data has the larger interquartile range?

(A) Boys

(B) Girls

(C) Neither, they are equal.

(D) It cannot be computed from the information given.

151. (11.2) A data set has 4 values: {1, 5, 6, 8}. The mean of the data set is 5. Which expression shows the computation of the standard deviation?

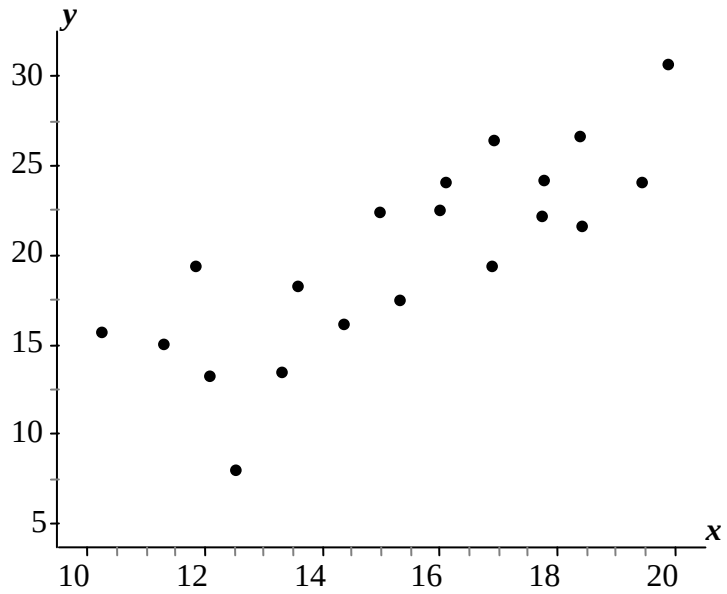
(A) $\sqrt{\frac{1+5+6+8}{3}}$

(B) $\sqrt{\frac{1+25+36+64}{3}}$

(C) $\sqrt{\frac{4+0+1+3}{3}}$

(D) $\sqrt{\frac{16+0+1+9}{3}}$

152. (11.2) Use the scatterplot below.



A linear model is fit to the data. What is the approximate value of its correlation coefficient?

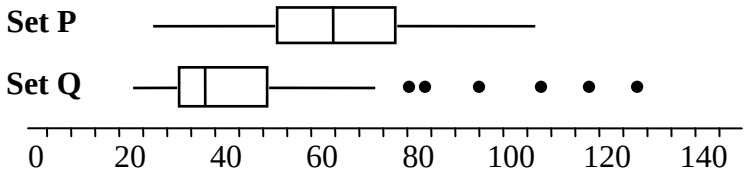
(A) $r = 0.8$

(B) $r = 1.0$

(C) $r = -0.8$

(D) $r = -1.0$

For questions 154-157, use the boxplots of two data sets, P and Q, below.



153. (11.3)Which data set has the larger median?

(A) Set P

(B) Set Q

(C) Neither, the medians are the same.

154. (11.3)Which data set has the larger interquartile range?

(A) Set P

(B) Set Q

(C) Neither, the interquartile ranges are the same.

155. (11.3)Which data set could be described as skewed left?

(A) Set P only

(B) Set Q only

(C) Both sets

(D) Neither set

156. (11.3)Which data set has values that are considered outliers?

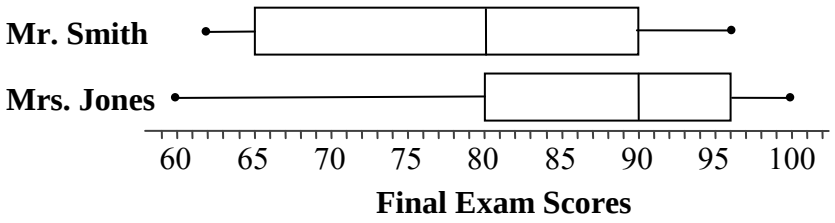
(A) Set P only

(B) Set Q only

(C) Both sets

(D) Neither set

157. (11.3) The distributions of two classes' final exam scores are shown below.



Which statement about the box-and-whisker plots is true?

(A) 50% of the scores for Mr. Smith's class are between 65 and 80.

(B) 50% of the scores for Mrs. Jones' class are between 80 and 100.

(C) The median scores for the two classes are the same.

(D) The interquartile range of scores for Mr. Smith's class is greater than the interquartile range of the scores for Mrs. Jones' class.

For questions 158-160, use the following scenario.

A survey asked 100 students whether or not they like two sports: soccer and tennis. The results of the survey are shown in the table.

		Likes Soccer	
		Yes	No
Likes Tennis	Yes	12	18
	No	48	22

158. (11.4)What is the relative frequency of students who like tennis, soccer, or both?

(A) 0.12

(B) 0.66

(C) 0.78

(D) 0.90

159. (11.4)What is the relative frequency of students who like tennis?

(A) 0.12

(B) 0.18

(C) 0.25

(D) 0.30

160. (11.4)What is the relative frequency of students who like both tennis and soccer?

(A) 0.12

(B) 0.30

(C) 0.60

(D) 0.78

161. (11.4)A high school principal randomly surveyed students about a change in the dress code. The results are shown in the table.

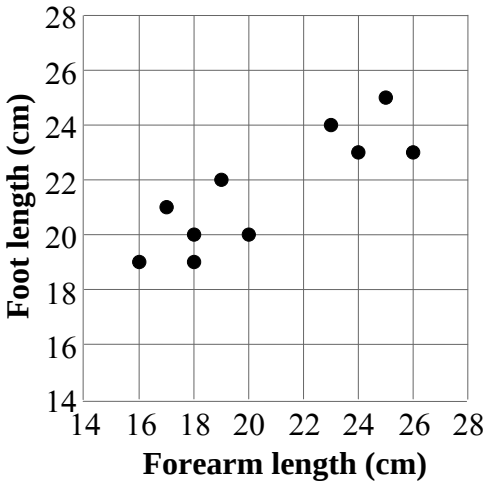
		Class		
		Freshmen	Sophomores	Juniors
Favors the change	Yes	56	38	32
	No	24	37	58

a) What percentage of <u>all</u> respondents favors the policy change?

b) Which class has the highest favorable percentage? Which class has the lowest favorable percentage?

c) Is there a relationship between class and favoring the dress code change? Explain.

162. (11.5)The scatterplot below represents the forearm lengths and foot lengths of 10 people.



Based on a linear model of the data, which is the <u>best</u> prediction for the length of a person's foot if his/her forearm length is 21 centimeters?

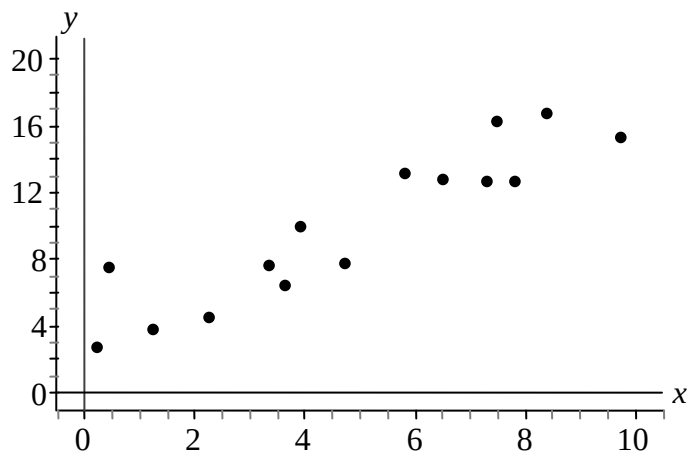
(A) 19 cm

(B) 20 cm

(C) 22 cm

(D) 24 cm

163. (11.5)The line of best fit for the scatterplot below is $\hat{y} = 1.4x + 2.9$



Predict y when $x = 6$.

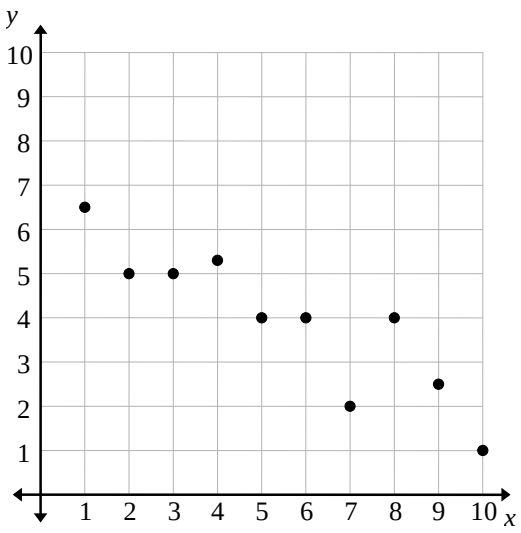
(A) 2.2

(B) 10.5

(C) 11.3

(D) 18.8

164. (11.5)Which equation best describes fits the data shown in the scatterplot?



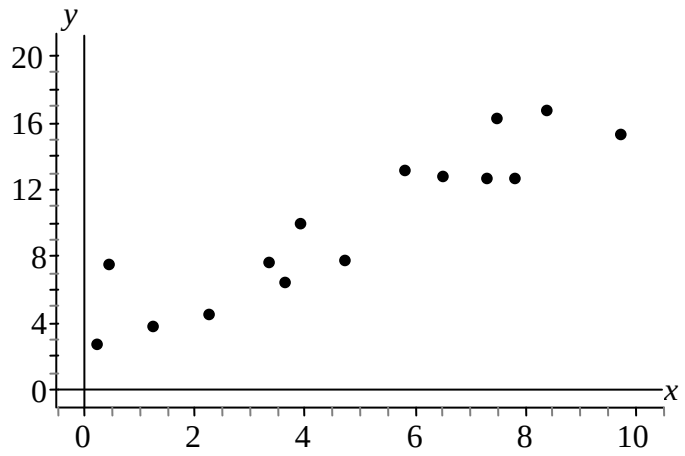
(A) $y = -\frac{3}{5}x + 7$

(B) $y = -\frac{1}{3}x + 8$

(C) $y = x + 8$

(D) $y = 4$

165. (11.5)The line of best fit for the scatterplot below is $\hat{y} = 1.4x + 2.9$



What is the residual for the point (4, 10)?

(A) –1.5

(B) 1.5

(C) 8.5

(D) 10

166. (11.5)A scatterplot is made of a city's population over time. The equation of the line of best fit is $\hat{p} = 629t + 150,000$ where $\hat{p}$ is the city's predicted population size and t is the number of years since 2000. What is the meaning of the slope of this line?

(A) In 2000, the city's population was about 629 people.

(B) In 2000, the city's population was about 150,000 people.

(C) The city's population increases by about 629 people each year.

(D) The city's population increases by about 150,000 people each year.

167. (11.5)The equation $\hat{y} = 31.4 - 0.12x$, gives the predicted population $\hat{y}$ of a city (in thousands) x years after 1975. What is meaning of the y-intercept?

(A) In 1975, the city's population was about 120 people.

(B) In 1975, the city's population was about 31,400 people.

(C) The city's population decreases by about 120 people each year.

(D) The city's population decreases by about 31,400 people each year.

168. (11.5)The equation $\hat{P} = -9.50m + 509$ gives the predicted price $\hat{P}$ of a particular style of television m months after the style first became available. What is the meaning of the P-intercept?

(A) The original price of the television was about \$9.50.

(B) The original price of the television was about \$509.00.

(C) The price of the television decreases by about \$9.50 each month.

(D) The price of the television increases by about \$509.00 each month.

169. (11.5)The data below comes from a scatterplot.

x	2	3	4	5	6	7	8	8	8	9	10	10
y	2	8	4	1	10	4	6	10	2	7	3	9

Which best describes the linear relationship between x and y?

(A) weak or no correlation

(B) strong positive correlation

(C) strong negative correlation

For questions 170-172, evaluate the truth of each statement about the correlation coefficient r.

170. (11.5)A value of r near zero indicates there is a weak linear relationship between x and y.

(A) True

(B) False

171. (11.5)A value of $r = -0.5$ indicates a weaker linear relationship between x and y than a value of $r = 0.5$.

(A) True

(B) False

172. (11.5)A value of $r = 1$ indicates that there is a cause-and-effect relationship between x and y.

(A) True

(B) False

For questions 173-174, use the following scenario.

A linear model describes the relationship between two variables, x and y. The correlation coefficient of the linear fit is $r = -0.9$.

173. (11.5)The slope of the line of best fit is negative.

(A) True

(B) False

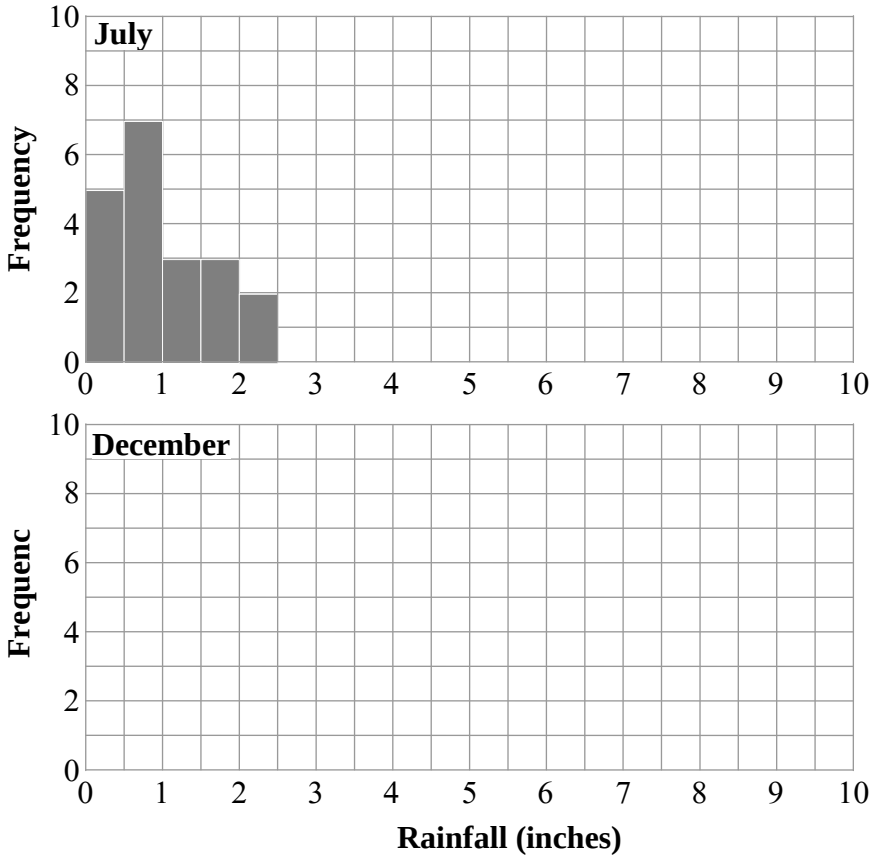
174. (11.5)The linear relationship between x and y is weak.

(A) True

(B) False

175. (11.5)The table shows the amount of rainfall in Seattle during the month of December in the years 1980–1999.

The histogram shows the distribution of rainfall in Seattle during the month of July in the same years, using intervals of 0.5 inches.



Monthly Rainfall (inches)	
Year	December
1980	7.4
1981	5.6
1982	6.2
1983	5.0
1984	5.0
1985	1.5
1986	6.8
1987	6.1
1988	7.5
1989	4.8
1990	3.1
1991	3.3
1992	4.1
1993	4.5
1994	8.2
1995	6.4
1996	5.2
1997	2.2
1998	9.0
1999	5.1

(a) Create a histogram on the grid above that shows the distribution of rainfall in December using intervals of 1.0 inch.

(b) Describe the shapes of the distributions for July and December.

(c) How does the mean rainfall for July compare to the median rainfall? Explain.

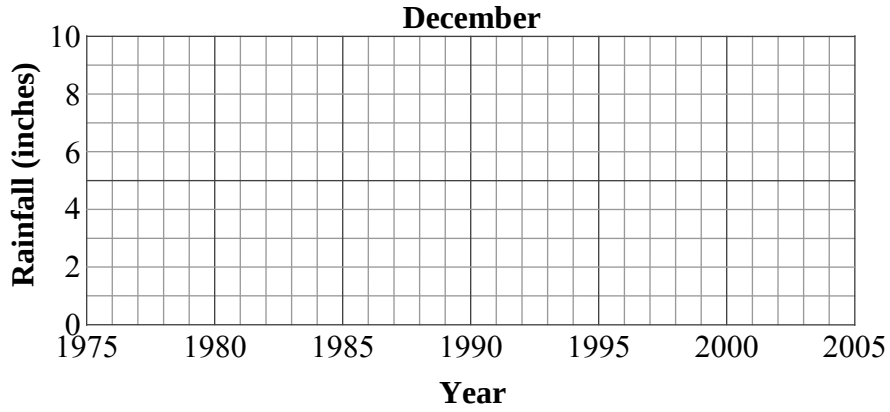
(d) Compare the median rainfalls for July and December over the period 1980–1999.

(e) Describe how to compute the standard deviation of the December rainfalls. (You do not have to actually compute it.)

(f) Which month's rainfall, July or December, has the greater standard deviation? Explain.

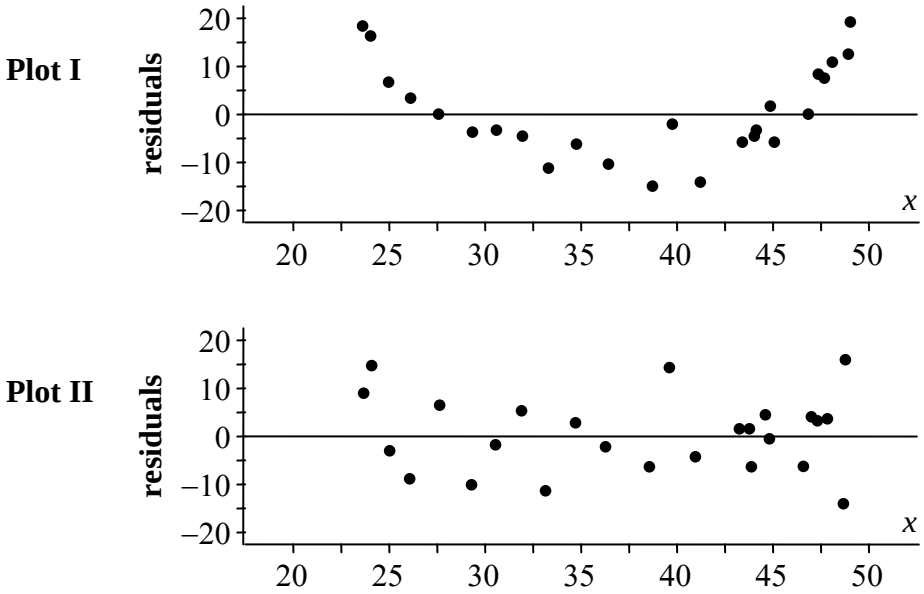
(g) One of the rainfall amounts for July was recorded at 2.4 inches. In actuality, it was only 1.4 inches. Explain how this would affect the mean and median of July rainfall.

(h) On the grid below, create a scatterplot showing December monthly rainfall over the period from 1980–1999.



(i) Describe the relationship between December rainfall and year.

176. (11.7)Two residual plots are shown below.



Which residual plot(s) would indicate a linear model is appropriate?

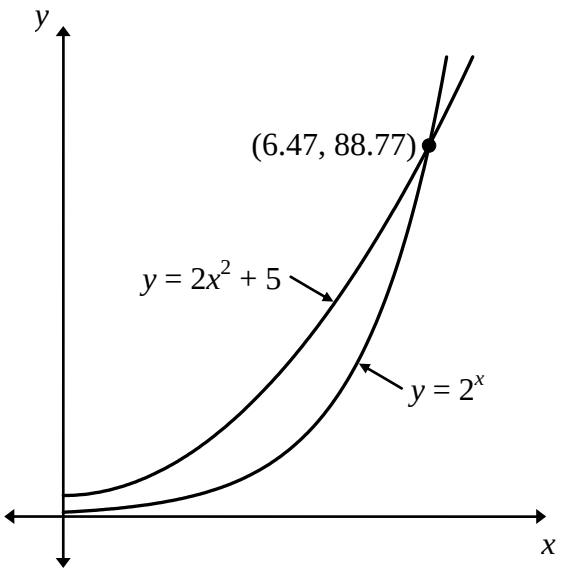
(A) Plot I only

(B) Plot II only

(C) Both Plot I and Plot II

(D) Neither Plot I nor Plot II

For question 177, use the graph below.



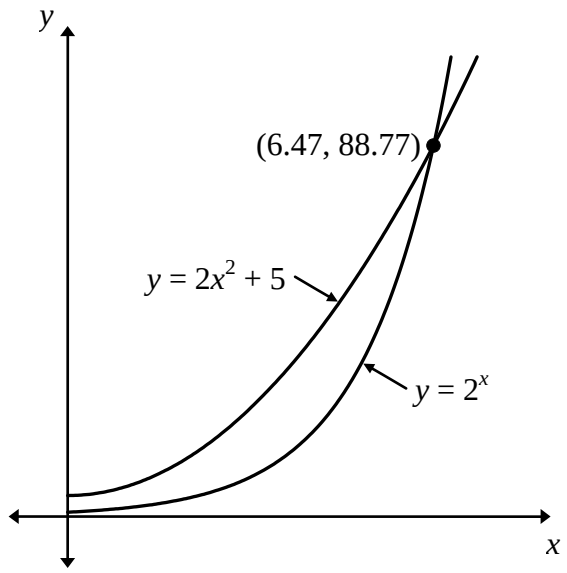
177. (12.1)There are values of $x < 0$ where $2^x > 2x^2 + 5$.

(A) True

(B) False

178. (12.1)The graph of $y = x^2 - 4$ intersects a line at (p, 0) and (t, 5). What is the greatest possible value of the slope? Explain your reasoning.

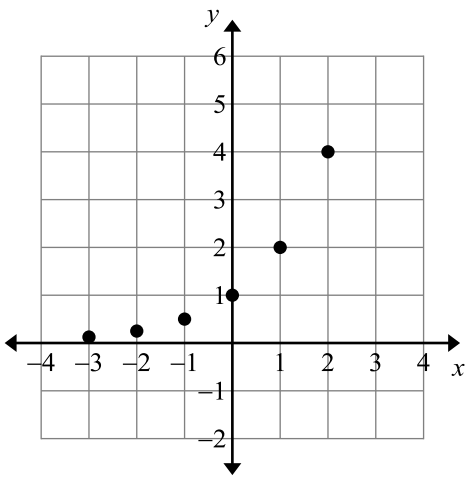
For question 179, use the graph below.



179. (12.2)There are values of $x > 7$ where $2x^2 + 5 > 2^x$.

(A) True
(B) False

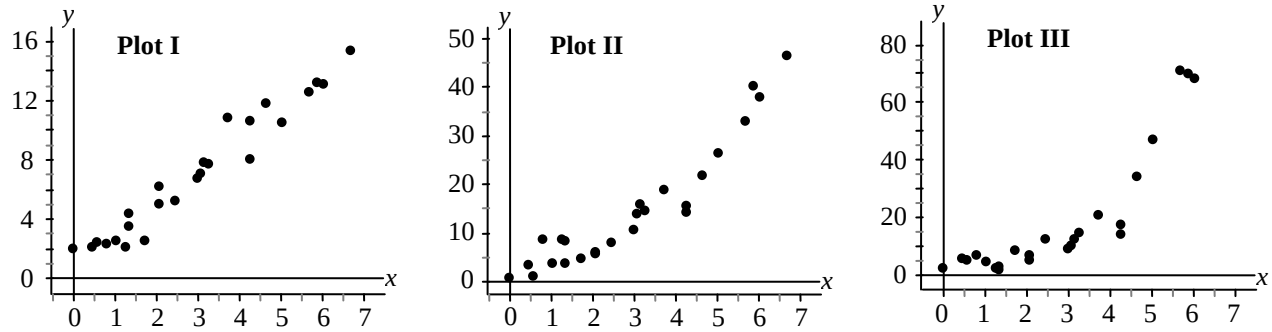
180. (12.3)The graph below shows a function.



Which model best describes the graph?

(A) absolute value
(B) exponential
(C) linear
(D) quadratic

181. (12.3)Three scatterplots are shown below.



Three functions are defined.

$f(x) = 2x + 1$ $\quad$ $g(x) = 2^x + 1$ $\quad$ $h(x) = x^2 + 1$

Match the functions to scatterplots as models for them.

(A) Plot I: $f(x)$ Plot II: $g(x)$ Plot III: $h(x)$

(B) Plot I: $f(x)$ Plot II: $h(x)$ Plot III: $g(x)$

(C) Plot I: $f(x)$ Plots II and III cannot be determined from the information given

(D) Plots I, II, and III cannot be determined from the information given