MCQ_Review_Unit_1

1.

x	$r(x)$
1.997	1.3337
1.998	1.3336
1.999	1.3334
2.001	1.3332
2.002	1.3331
2.003	1.3330

The rational function r is given by $r(x) = \frac{x^2-4}{x^2-x-2}$. The table gives values of $r(x)$ for selected values of x. Which of the following statements is true?

(A) $\lim\limits_{x\to 2} r(x) = \frac{4}{3}$, so $r(2) = \frac{4}{3}$.

(B) $\lim\limits_{x\to 2} r(x) = \frac{4}{3}$ and r is undefined at $x = 2$, so the graph of r has a hole at $\left(2, \frac{4}{3}\right)$.

(C) $\lim\limits_{x\to \frac{4}{3}} r(x) = 2$ and r is undefined at $x = 2$, so the graph of r has a hole at $\left(2, \frac{4}{3}\right)$.

(D) $\lim\limits_{x\to 2^+} r(x) = \infty$, $\lim\limits_{x\to 2^-} r(x) = \infty$, and r is undefined at $x = 2$, so the graph of r has a vertical asymptote at $x = 2$.

2. The polynomial function p is given by $p(x) = (x+3)\left(x^2 - 2x - 15\right)$. Which of the following describes the zeros of p ?

(A) p has exactly two distinct real zeros.

(B) p has exactly three distinct real zeros.

(C) p has exactly one distinct real zero and no non-real zeros.

(D) p has exactly one distinct real zero and two non-real zeros.

MCQ_Review_Unit_1

3. In the xy-plane, the graph of the rational function f has a vertical asymptote at $x = 4$. Which of the following expressions could define $f(x)$?

(A) $\frac{(x+1)^3(x-4)^2}{(x+1)^2(4-x)^3}$

(B) $\frac{(x+1)^3(x-4)^2}{(x+1)^2(4-x)^2}$

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

(D) $\frac{(x+1)^2(x-4)^2}{(4x+4)^2(4+x)^3}$

4. The function h is given by $h(x) = \frac{2x^3}{x+3} - \frac{4}{x-1}$. Which of the following statements is true?

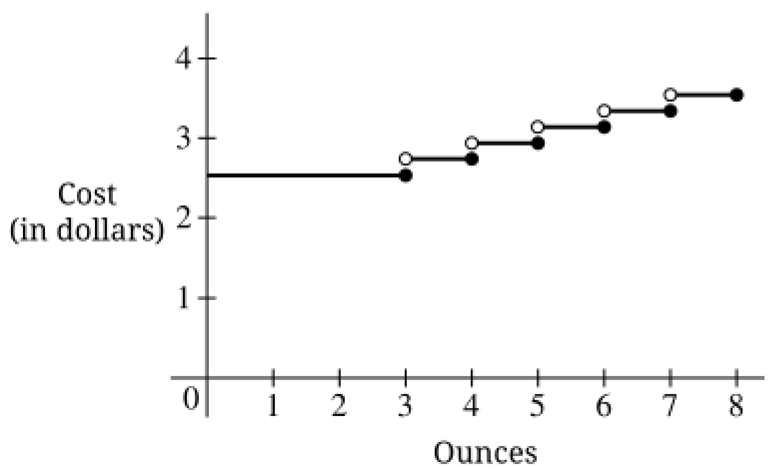
(A) h is equivalent to $\frac{2x^4-2x^3-4x-12}{x^2+2x-3}$ and has the same end behavior as the graph of $y = 2x^2$.

(B) h is equivalent to $\frac{2x^3-4}{x^2+2x-3}$ and has the same end behavior as the graph of $y = 2x$.

(C) h is equivalent to $\frac{2x^3}{x} + \frac{2x^3}{3} - \frac{4}{x-1}$ and has the same end behavior as the graph of $y = 2x^2$.

(D) h is equivalent to $\frac{2x^2-2x-12}{3x-3}$ and has the same end behavior as the graph of $y = 2x$.

5.



In 2016, the cost to mail a package was $\$2.54$ for up to 3 ounces, plus an additional cost of $\$0.20$ for each additional ounce or portion of an ounce less than a full ounce. A portion of the graph of this relationship is given with cost, in dollars, as a function of ounces. Which of the following describes the restrictions on the range for such a function?

(A) The range is positive real numbers.

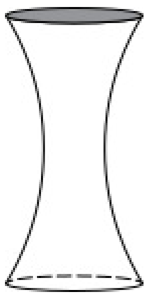
(B) The range is positive integers.

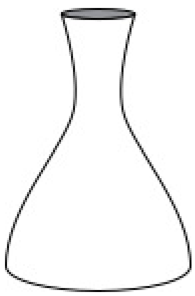
(C) The range is values of the form $2.54 + 0.2x$, where x is a nonnegative real number.

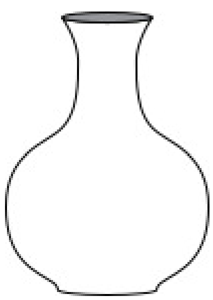
(D) The range is values of the form $2.54 + 0.2x$, where x is a nonnegative integer.

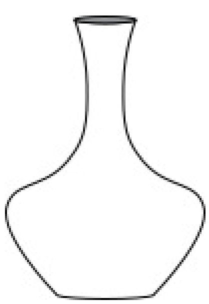
MCQ_Review_Unit_1

6. Water is poured into an empty vase at a constant rate. A graph (not shown) models the depth of the water in the vase over time. The graph can be described as follows: the graph is always increasing; the first portion of the graph is clearly concave up; and the next portion of the graph has a fairly steady and steep increase. Which of the following vases is appropriate for the context described by the graph?

(A) 

(B) 

(C) 

(D) 

7. The polynomial function p is given by $p(x) = (x+2)^4$. Which of the following expressions is equivalent to $(x+2)^4$?

(A) $x^4 + 2x^3 + 4x^2 + 8x + 16$

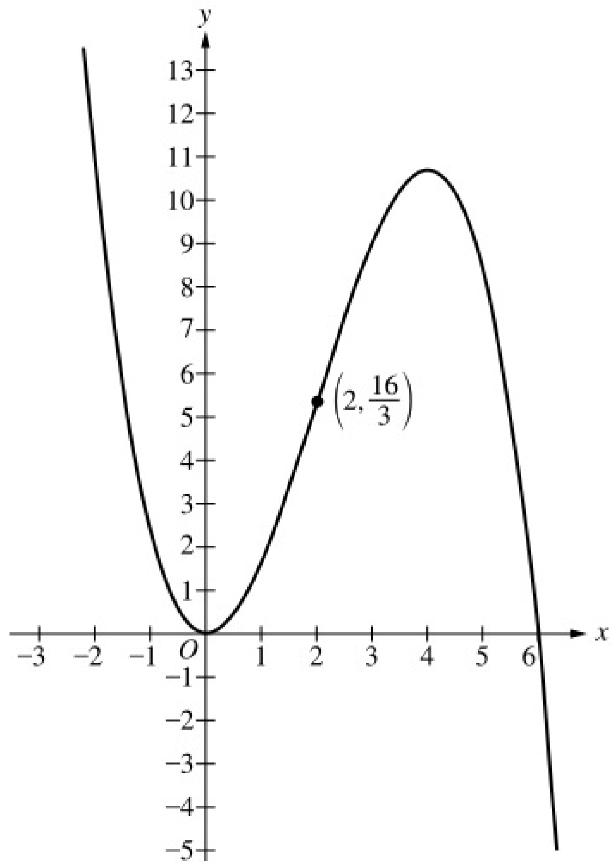
(B) $x^4 + 4x^3 + 6x^2 + 4x + 1$

(C) $x^4 + 8x^3 + 24x^2 + 32x + 16$

(D) $2x^4 + 8x^3 + 12x^2 + 8x + 2$

MCQ_Review_Unit_1

8.



Graph of f

The graph of the function f is given for $-3 \leq x \leq 6$. Which of the following statements about the rate of change of f over the interval $2 < x < 6$ is true?

(A) The rate of change is positive.

(B) The rate of change is negative.

(C) The rate of change is increasing.

(D) The rate of change is decreasing.

9. The polynomial function f is given by $f(x) = 2x^3 - 3x^2 - 23x + 12$. Which of the following is true about $\frac{f(x)}{x+3}$?

(A) The remainder of $\frac{f(x)}{x+3}$ is 0. The quotient of $\frac{f(x)}{x+3}$ is a quadratic polynomial that factors into two linear factors involving only real numbers.

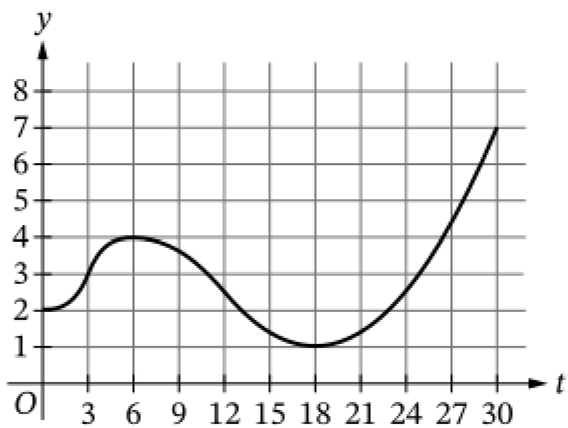
(B) The remainder of $\frac{f(x)}{x+3}$ is 0. The quotient of $\frac{f(x)}{x+3}$ is a quadratic polynomial that does not factor into linear factors involving only real numbers.

(C) The remainder of $\frac{f(x)}{x+3}$ is a nonzero constant. The quotient of $\frac{f(x)}{x+3}$ is a quadratic polynomial that factors into two linear factors involving only real numbers.

(D) The remainder of $\frac{f(x)}{x+3}$ is a nonzero constant. The quotient of $\frac{f(x)}{x+3}$ is a quadratic polynomial that does not factor into linear factors involving only real numbers.

MCQ_Review_Unit_1

10.



Graph of W

The depth of water, in feet, at a certain place in a lake is modeled by a function W. The graph of $y = W(t)$ is shown for $0 \le t \le 30$, where t is the number of days since the first day of a month. What are all intervals of t on which the depth of water is increasing at a decreasing rate?

(A) $(3{,}6)$ only

(B) $(3{,}12)$

(C) $(0{,}3)$ and $(18{,}30)$ only

(D) $(0{,}6)$ and $(18{,}30)$

11. Jordan’s cell phone plan includes 5 gigabytes (GB) of data per month and has a monthly cost of $\$79.95$. If Jordan uses more than 5 GB of data within the month, there is a charge of $\$10$ per additional gigabyte of data used. Function C is used to model Jordan’s monthly cell phone bill, where d is the number of gigabytes of data used and $C(d)$ is the cost in dollars. Which of the following defines function C ?

(A) $C(d) = \begin{cases} 79.95 & \text{for } 0 \le d \le 5 \\ 79.95 + 10(d-5) & \text{for } d > 5 \end{cases}$

(B) $C(d) = \begin{cases} 79.95 & \text{for } 0 \le d \le 5 \\ 79.95 + 10d & \text{for } d > 5 \end{cases}$

(C) $C(d) = \begin{cases} 79.95 & \text{for } 0 \le d \le 5 \\ 79.95d + 10 & \text{for } d > 5 \end{cases}$

(D) $C(d) = 79.95 + 10d$

12. For the polynomial function g, $\lim\limits_{x \to -\infty} g(x) = -\infty$. Which of the following expressions could define $g(x)$?

(A) $-5x - 2x^4$

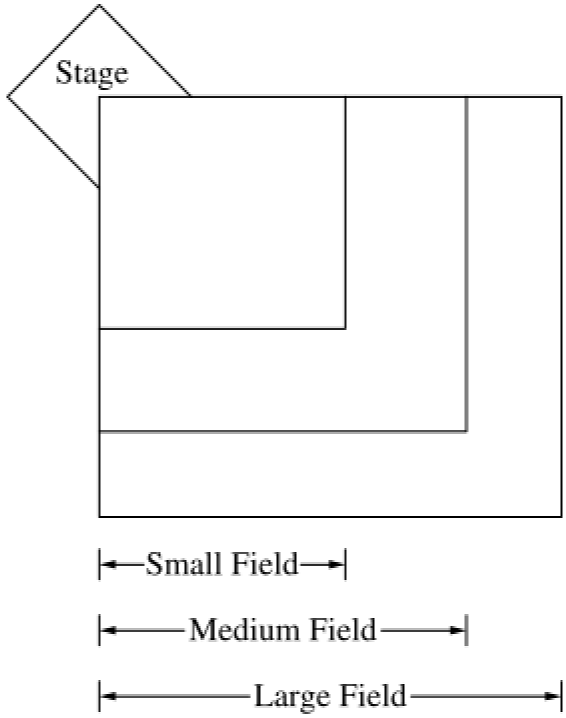
(B) $-5x^2 - 2x^7$

(C) $-9000x - \frac{x^5}{5}$

(D) $-x^3 + 2x^4$

MCQ_Review_Unit_1

13.



A music agent is planning a series of concerts at local farms around the nation. The agent is building a model to estimate crowd capacity based on different sizes of square fields. Which type of function is most likely to model crowd capacity in this situation?

(A) Linear
(B) Piecewise linear
(C) Quadratic
(D) Cubic

14. The rational function r is given by $r(x) = \frac{x^3+8x^2+17x+10}{x^2+2x} = \frac{(x+1)(x+2)(x+5)}{x^2+2x}$. Which of the following gives equations for all the horizontal asymptotes, vertical asymptotes, and slant asymptotes of the graph of r ?

(A) $x = 0$ and $y = x + 6$
(B) $x = 0$ and $x = -2$
(C) $x = 0$ and $y = 5x + 10$
(D) $x = 0$ and $y = x + 10$

15. The function f is given by $f(x) = (x+3)^4$. When f is rewritten in the form $f(x) = x^4 + ax^3 + bx^2 + cx + d$, which of the following values is greatest?

(A) a
(B) b
(C) c
(D) d

MCQ_Review_Unit_1

16.

Interval	$0 < x < 1$	$1 < x < 2$	$2 < x < 3$	$3 < x < 4$	$4 < x < 5$	$5 < x < 6$	$6 < x < 7$
Change in $f(x)$	2.1	2.0	2.1	2.2	2.1	2.2	2.0
Change in $g(x)$	2.1	3.2	4.2	5.1	6.3	7.2	8.3
Change in $h(x)$	2.1	2.0	2.1	4.2	4.1	4.2	4.0
Change in $k(x)$	2.1	3.2	4.2	5.1	4.2	3.2	2.1

The table gives the average rates of change for the functions f, g, h, and k for certain intervals of x. Which of the functions is best modeled by a piecewise-linear function with two linear segments with different slopes?

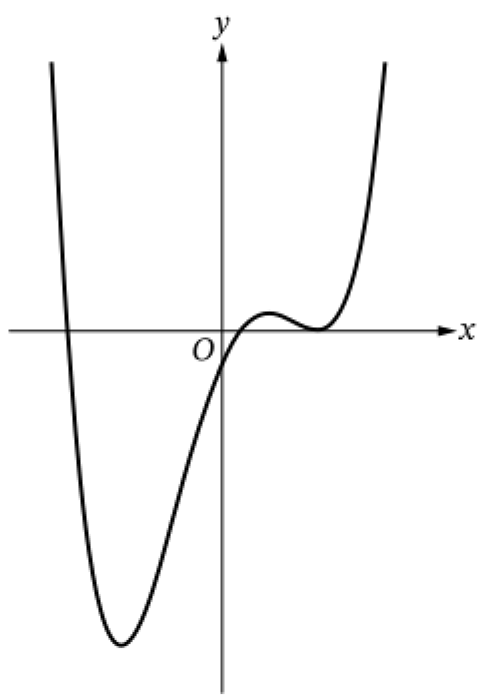
(A) f

(B) g

(C) h

(D) k

17.



Graph of g

The figure shown is the graph of a polynomial function g. Which of the following could be an expression for $g(x)$?

(A) $0.25(x-5)(x-1)(x+8)$

(B) $0.25(x+5)(x+1)(x-8)$

(C) $0.25(x-5)^2(x-1)(x+8)$

(D) $0.25(x+5)^2(x+1)(x-8)$

MCQ_Review_Unit_1

18. The function f is defined for all real values of x. For a constant a, the average rate of change of f from $x = a$ to $x = a + 1$ is given by the expression $2a + 1$. Which of the following statements is true?

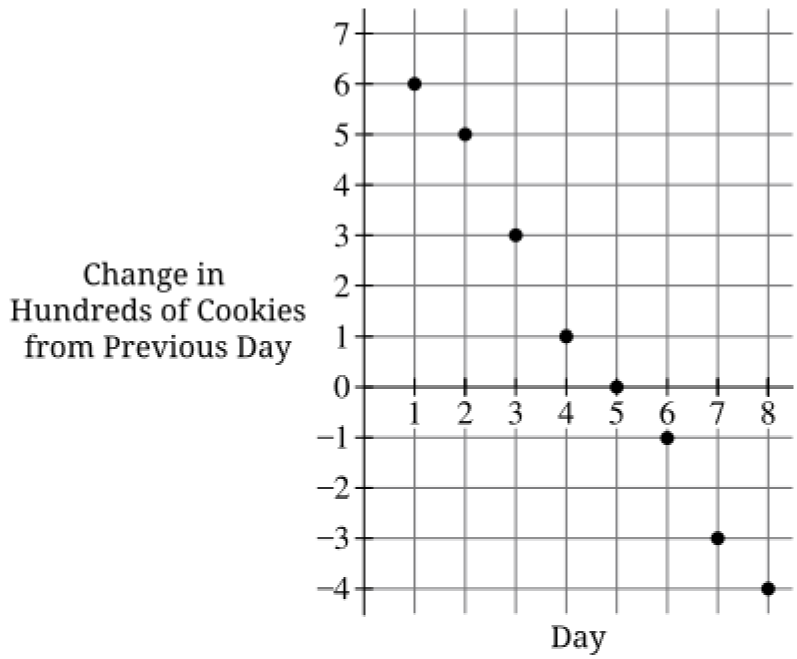
(A) The average rate of change of f over consecutive equal-length input-value intervals is positive, so the graph of f could be a line with a positive slope.

(B) The average rate of change of f over consecutive equal-length input-value intervals is positive, so the graph of f could be a parabola that opens up.

(C) The average rate of change of f over consecutive equal-length input-value intervals is increasing at a constant rate, so the graph of f could be a line with a positive slope.

(D) The average rate of change of f over consecutive equal-length input-value intervals is increasing at a constant rate, so the graph of f could be a parabola that opens up.

19.



At a bakery, the number of cookies baked each day changes based on anticipated demand. The scatterplot shows the change in hundreds of cookies baked from the previous day for eight days. The point at $(2, 5)$ means that on day 2, the number of cookies baked will be 500 more than the number of cookies baked on day 1. A function model C is to be constructed for the number of cookies baked on each of the days, 0 through 8. Which of the following statements best supports the selection of a model for C ?

(A) Because the information about rate of change is roughly linear, a linear model is best for C.

(B) Because the information about rate of change is roughly linear, a quadratic model is best for C.

(C) Because the information about rate of change is positive and negative, a quadratic model is best for C.

(D) Because the information about rate of change is positive and negative, a piecewise-linear model is best for C .

MCQ_Review_Unit_1

20. The ancient Pythagoreans studied figurate numbers, which are numbers that can be shown by taking dots or spheres and arranging them into geometric shapes. For example, the square numbers are $1, 4, 9, 16, 25$, etc., and each of these numbers of dots can be arranged into a square. The tetrahedral numbers similarly specify the number of spheres needed to create a tetrahedron, which is a triangular-based pyramid. The tetrahedral numbers are $1, 4, 10, 20, 35, 56, 84$, etc. Which of the following statements is true?

(A) The tetrahedral numbers are best modeled by a quadratic function because the 2nd differences are a nonzero constant.

(B) The tetrahedral numbers are best modeled by a quadratic function because the 3rd differences are a nonzero constant.

(C) The tetrahedral numbers are best modeled by a cubic function because the 2nd differences are a nonzero constant.

(D) The tetrahedral numbers are best modeled by a cubic function because the 3rd differences are a nonzero constant.

21. For a polynomial function f, $\lim\limits_{x\to-\infty} f(x)=\infty$ and $\lim\limits_{x\to\infty} f(x)=-\infty$. Which of the following must be true about f ?

(A) The degree of f is even, and the leading coefficient is negative.

(B) The degree of f is even, and the leading coefficient is positive.

(C) The degree of f is odd, and the leading coefficient is negative.

(D) The degree of f is odd, and the leading coefficient is positive.

22. The function f is given by $f(x)=-2x^7+5x^4+6x^2-3$. Which of the following correctly describes the end behavior of f as the input values increase without bound?

(A) $\lim\limits_{x\to\infty} f(x)=\infty$

(B) $\lim\limits_{x\to\infty} f(x)=-\infty$

(C) $\lim\limits_{x\to-\infty} f(x)=\infty$

(D) $\lim\limits_{x\to-\infty} f(x)=-\infty$

23. The polynomial function p is given by $p(x)=-4x^5+3x^2+1$. Which of the following statements about the end behavior of p is true?

(A) The sign of the leading term of p is positive, and the degree of the leading term of p is even; therefore, $\lim\limits_{x\to-\infty} p(x)=\infty$ and $\lim\limits_{x\to\infty} p(x)=\infty$.

(B) The sign of the leading term of p is negative, and the degree of the leading term of p is odd; therefore, $\lim\limits_{x\to-\infty} p(x)=\infty$ and $\lim\limits_{x\to\infty} p(x)=-\infty$.

(C) The sign of the leading term of p is positive, and the degree of the leading term of p is odd; therefore, $\lim\limits_{x\to-\infty} p(x)=-\infty$ and $\lim\limits_{x\to\infty} p(x)=\infty$.

(D) The sign of the leading term of p is negative, and the degree of the leading term of p is odd; therefore, $\lim\limits_{x\to-\infty} p(x)=-\infty$ and $\lim\limits_{x\to\infty} p(x)=\infty$.

MCQ_Review_Unit_1

24. The function f is given by $f(x) = 5x^6 - 2x^3 - 3$. Which of the following describes the end behavior of f ?

(A) $\lim_{x \to -\infty} f(x) = -\infty$ and $\lim_{x \to \infty} f(x) = -\infty$

(B) $\lim_{x \to -\infty} f(x) = \infty$ and $\lim_{x \to \infty} f(x) = \infty$

(C) $\lim_{x \to -\infty} f(x) = -\infty$ and $\lim_{x \to \infty} f(x) = \infty$

(D) $\lim_{x \to -\infty} f(x) = \infty$ and $\lim_{x \to \infty} f(x) = -\infty$

25. The polynomial function p is an odd function. If $p(3) = -4$ is a relative maximum of p, which of the following statements about $p(-3)$ must be true?

(A) $p(-3) = 4$ is a relative maximum.

(B) $p(-3) = -4$ is a relative maximum.

(C) $p(-3) = 4$ is a relative minimum.

(D) $p(-3) = -4$ is a relative minimum.

26. The function f is given by $f(x) = 3x^2 + 2x + 1$. The graph of which of the following functions is the image of the graph of f after a vertical dilation of the graph of f by a factor of 2 ?

(A) $m(x) = 12x^2 + 4x + 1$, because this is a multiplicative transformation of f that results from multiplying each input value x by 2.

(B) $k(x) = 6x^2 + 4x + 2$, because this is a multiplicative transformation of f that results from multiplying $f(x)$ by 2.

(C) $p(x) = 3(x+2)^2 + 2(x+2) + 1$, because this is an additive transformation of f that results from adding 2 to each input value x.

(D) $n(x) = 3x^2 + 2x + 3$, because this is an additive transformation of f that results from adding 2 to $f(x)$.

27.

x	-1	1	3	5	7
$f(x)$	-36	0	4	0	12

Values of the polynomial function f for selected values of x are given in the table. If all of the zeros of the function f are given in the table, which of the following must be true?

(A) The function f has a local minimum at $(-1, -36)$.

(B) The function f has a local minimum at $(5, 0)$.

(C) The function f has a local maximum at $(3, 4)$.

(D) The function f has a local maximum at $(1, 0)$.

MCQ_Review_Unit_1

28. The function f has a negative average rate of change on every interval of x in the interval $0 \leq x \leq 10$. The function g has a negative average rate of change on every interval of x in the interval $0 \leq x < 5$, and a positive average rate of change on every interval of x in the interval $5 < x \leq 10$. Which of the following statements must be true about the function h, defined by $h(x) = f(x) + g(x)$, on the interval $0 \leq x \leq 10$?

(A) h is decreasing on $0 \leq x \leq 10$.

(B) h is decreasing on $0 \leq x < 5$; h is increasing on $5 < x \leq 10$.

(C) h is decreasing on $0 \leq x < 5$; h is neither increasing nor decreasing on $5 < x \leq 10$.

(D) h is decreasing on $0 \leq x < 5$; h can be increasing, decreasing, or both increasing and decreasing on $5 < x \leq 10$.

29. The functions g and f are given by $g(x) = 3x^2 - 2x$ and $f(x) = 6x^4 + 5x^3 + 3x - 5$. Which of the following statements is true about the remainder when $f(x)$ is divided by $g(x)$?

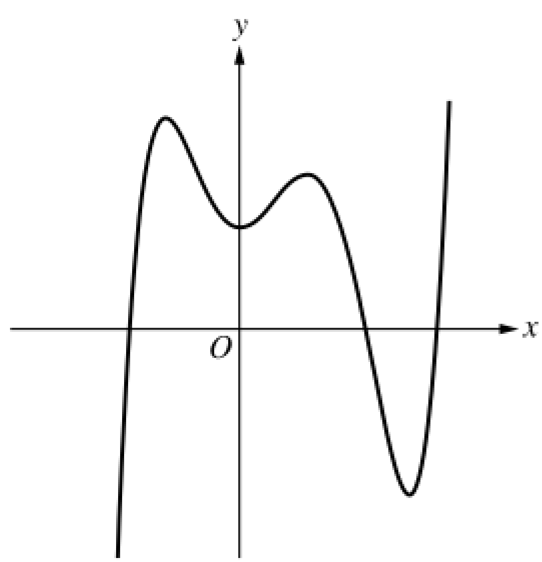
(A) The remainder is 0, so $g(x)$ is a factor of $f(x)$.

(B) The remainder is 0, so $f(x)$ is a factor of $g(x)$.

(C) The remainder is $(7x - 5)$, so $g(x)$ is not a factor of $f(x)$, and the graph of $y = \frac{f(x)}{g(x)}$ has a slant asymptote.

(D) The remainder is $(7x - 5)$, so $g(x)$ is not a factor of $f(x)$, and the graph of $y = \frac{f(x)}{g(x)}$ does not have a slant asymptote.

30.



Graph of f

The graph of the polynomial function f is shown. How many points of inflection does the graph of f have on the given portion of the graph?

(A) One

(B) Three

(C) Four

(D) Five

31. The polynomial function f is given by $f(x) = (x-4)(3x-1)^2$. Which of the following descriptions of f is true?

(A) f is a polynomial of degree 2 with a leading coefficient of 3.

(B) f is a polynomial of degree 2 with a leading coefficient of 9.

(C) f is a polynomial of degree 3 with a leading coefficient of 3.

(D) f is a polynomial of degree 3 with a leading coefficient of 9.

32. A polynomial function has the form $p(x) = ax^j + bx^k$, where a and b are nonzero constants, j and k are nonnegative integers. Which of the following conditions guarantees that p is an even function?

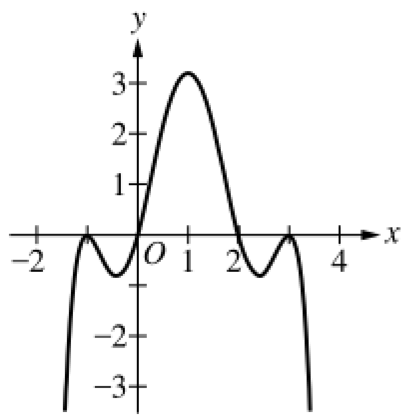
(A) $k = 0$

(B) $j = 2k$ and k is even.

(C) $j + k$ is even.

(D) $j \cdot k$ is even.

33.



Graph of g

The graph of the polynomial function g is shown. The function f is defined for $0 \le x \le 3$ and is identical to the function g on that interval. How many total local minima and local maxima does the function f have?

(A) Two

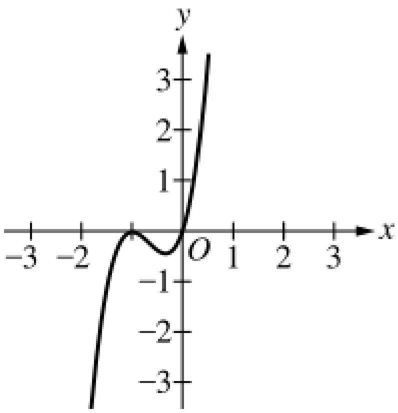
(B) Four

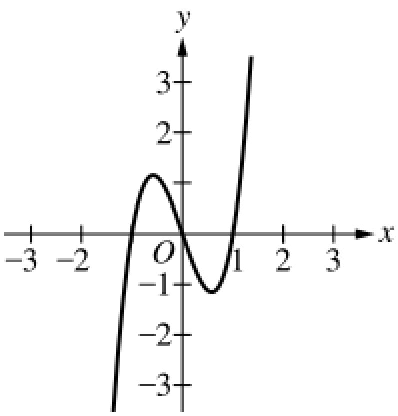
(C) Five

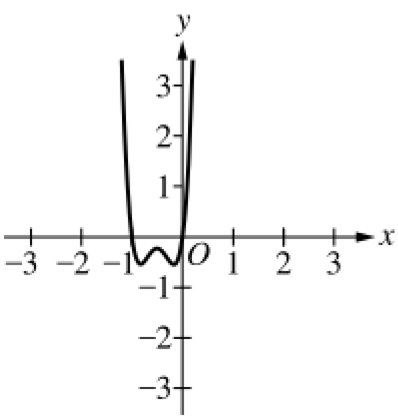
(D) Seven

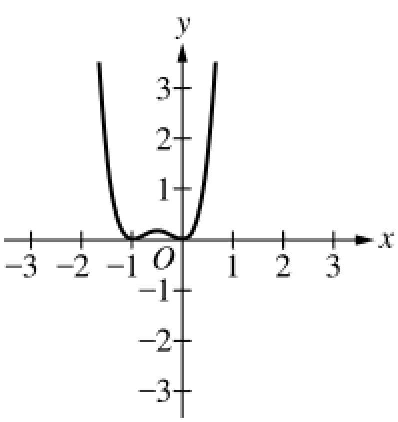
34. The polynomial function P is given by $P(x) = 3x(x+1)^2(x-a)$, where a is a real number. Which of the following could be the graph of $y = P(x)$?

MCQ_Review_Unit_1

(A) 

(B) 

(C) 

(D) 

MCQ_Review_Unit_1

35.

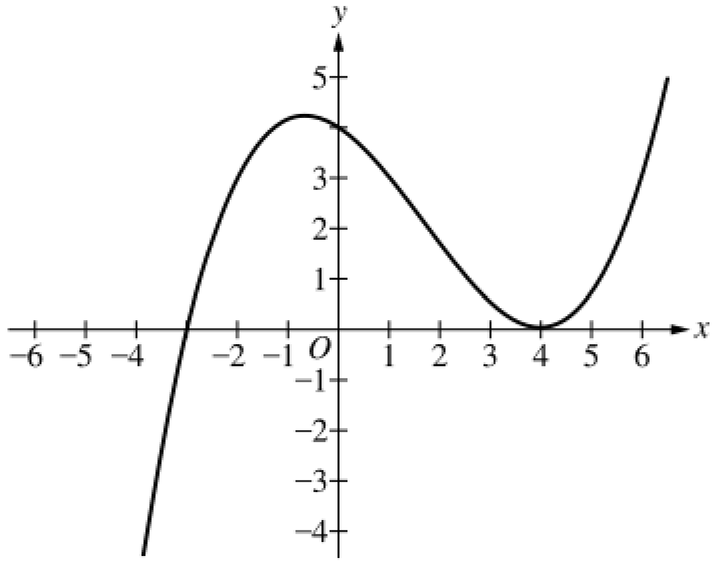
x	$Q(x)$
-4	389
-3	139
-2	35
-1	5
0	1
1	-1
2	-1
3	25
4	125

The table gives values of a polynomial function Q for selected values of x. What is the degree of Q ?

(A) 2
(B) 3
(C) 4
(D) 5

MCQ_Review_Unit_1

36.



Graph of P

The graph of the polynomial function $y = P(x)$ is shown. Which of the following could define $P(x)$?

(A) $P(x) = \frac{(x-4)(x+3)^2}{12}$

(B) $P(x) = \frac{(x-4)^2(x+3)}{12}$

(C) $P(x) = \frac{(x+4)(x-3)^2}{12}$

(D) $P(x) = \frac{(x+4)^2(x-3)}{12}$

37. The leading term of the polynomial function p is $a_n x^n$, where a_n is a real number and n is a positive integer. The factors of p include $(x-3)$, $(x-i)$, and $(x-(2+i))$. What is the least possible value of n ?

(A) 3

(B) 4

(C) 5

(D) 6

38. The function Q is a polynomial of degree 3. If $Q(5) = 0$, which of the following must be true?

(A) $Q(-5) = 0$

(B) Q has two complex zeros.

(C) $Q(x)$ can be expressed as $(x-5) \cdot P(x)$, where $P(x)$ is a polynomial of degree 2.

(D) $Q(x)$ can be expressed as $\frac{P(x)}{x-5}$, where $P(x)$ is a polynomial of degree 4.

MCQ_Review_Unit_1

39.

x	-3	3	6
$f(x)$	-10	-2	2

The table gives values of the function f for selected values of x. If the function f is linear, what is the value of $f(13)$?

(A) 4
(B) $\frac{29}{4}$
(C) $\frac{28}{3}$
(D) $\frac{34}{3}$

40.

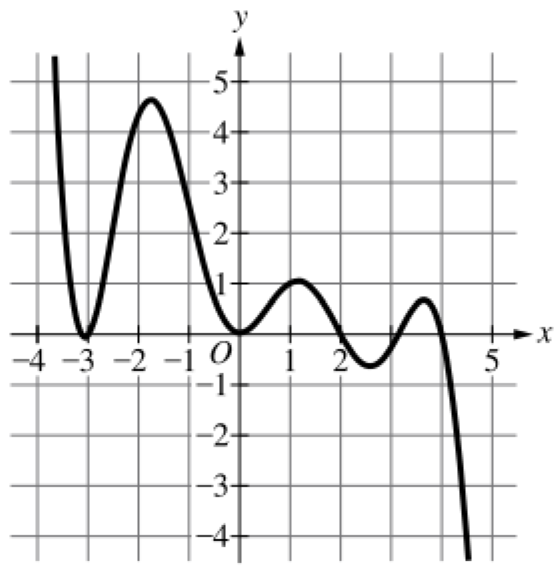
Interval	$0 \leq x \leq 1$	$1 \leq x \leq 4$	$4 \leq x \leq 8$	$8 \leq x \leq 10$
Average Rate of Change	10	-5	2	6

The table gives the average rates of change of a function f over different intervals. On which of the intervals does the function increase the most?

(A) $0 \leq x \leq 1$
(B) $1 \leq x \leq 4$
(C) $4 \leq x \leq 8$
(D) $8 \leq x \leq 10$

MCQ_Review_Unit_1

41.



Graph of g

The graph of the function $y = g(x)$ is given. Of the following, on which interval is the average rate of change of g least?

(A) $-3 \le x \le -2$

(B) $-1 \le x \le 0$

(C) $1 \le x \le 2$

(D) $3 \le x \le 4$

42. The average rate of change of the quadratic function p is -4 on the interval $0 \le x \le 2$ and -1 on the interval $2 \le x \le 4$. What is the average rate of change of p on the interval $6 \le x \le 8$?

(A) 2

(B) 3

(C) 5

(D) The average rate of change on the interval $6 \le x \le 8$ cannot be determined from the information given.

43.

Time (seconds)	1	3	6	11
Distance (meters)	1	9	21	41

An object is moving in a straight line from a starting point. The distance, in meters, from the starting point at selected times, in seconds, is given in the table. If the pattern is consistent, which of the following statements about the rate of change of the rates of change of distance over time is true?

(A) The rate of change of the rates of change is 0 meters per second, and the object is neither speeding up nor slowing down.

(B) The rate of change of the rates of change is 0 meters per second per second, and the object is neither speeding up nor slowing down.

(C) The rate of change of the rates of change is 4 meters per second, and the object is neither speeding up nor slowing down.

(D) The rate of change of the rates of change is 4 meters per second per second, and the object is speeding up.

44.

x	-2	-1	0	1
$f(x)$	5	2	1	2

The table gives values of a function f for selected values of x. Which of the following conclusions with reason is consistent with the data in the table?

(A) f could be a linear function because the rates of change over consecutive equal-length intervals in the table can be described by $y = 2x$.

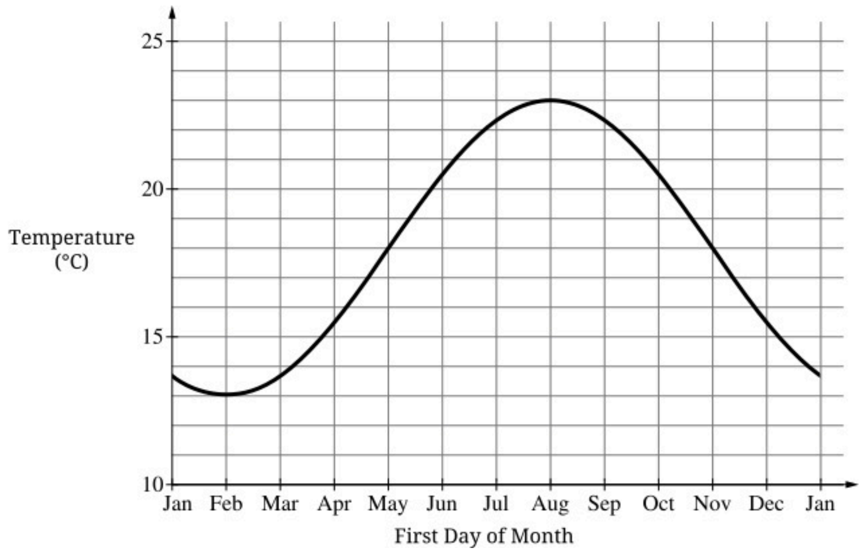
(B) f could be a linear function because the rates of change over consecutive equal-length intervals in the table can be described by $y = 2x + 1$.

(C) f could be a quadratic function because the rates of change over consecutive equal-length intervals in the table can be described by $y = 2x$.

(D) f could be a quadratic function because the rates of change over consecutive equal-length intervals in the table can be described by $y = 2x + 1$.

MCQ_Review_Unit_1

45.



The daily high temperature at a certain point in a river is modeled by the graph. Each point on a vertical gridline indicates the temperature, in degrees Celsius, on the first day of the indicated month. Of the following, on the first day of which month is the rate of change of the temperature the greatest?

(A) February

(B) May

(C) August

(D) November

46.

x	$1 < x < 2$	$2 < x < 3$	$3 < x < 4$	$4 < x < 5$
Rate of change of $f(x)$	Positive and increasing	Negative and increasing	Positive and decreasing	Negative and decreasing

The table gives characteristics of the rates of change of the function f on different intervals. Which of the following is true about f on the interval $3 < x < 4$?

(A) f is increasing, and the graph of f is concave down.

(B) f is increasing, and the graph of f is concave up.

(C) f is decreasing, and the graph of f is concave down.

(D) f is decreasing, and the graph of f is concave up.

47. The function f is not explicitly given. The function g is given by $g(x) = f(x+1) - f(x)$. The function h is given by $h(x) = g(x+1) - g(x)$. If $h(x) = -6$ for all values of x, which of the following statements must be true?

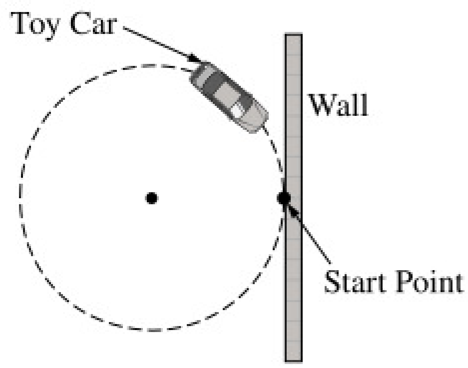
(A) Because h is negative and constant, the graphs of g and f always have negative slope.

(B) Because h is negative and constant, the graphs of g and f are concave down.

(C) Because h is negative and constant, g is decreasing, and the graph of f always has negative slope.

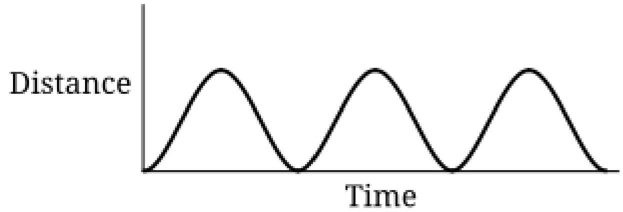
(D) Because h is negative and constant, g is decreasing, and the graph of f is concave down.

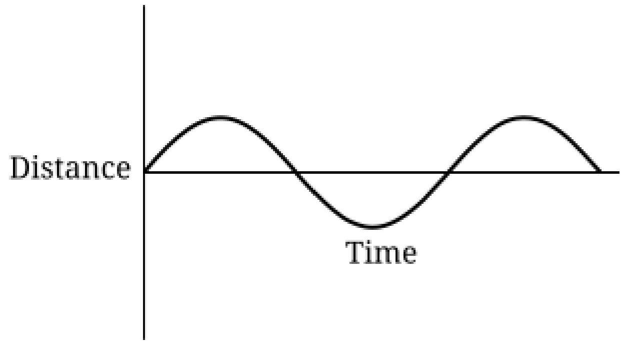
48.

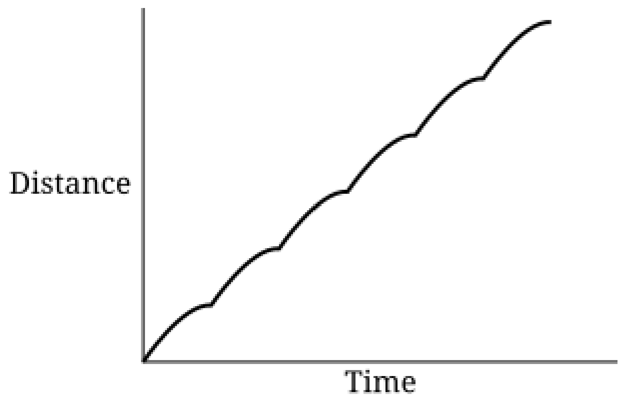


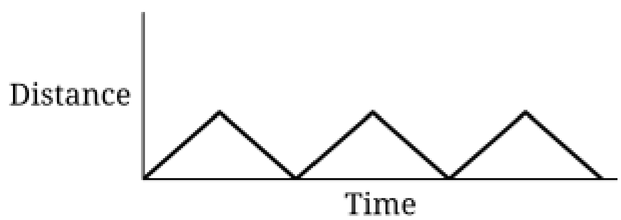
A toy car travels around a circular track as shown in the figure. As the toy car travels around the track, its distance from the wall can be modeled by a graph where the y-axis represents the distance between the car and the wall, and the x-axis represents time. Which of the following graphs models this relationship as the car goes around the track three times without stopping?

MCQ_Review_Unit_1

(A) 

(B) 

(C) 

(D) 

49. The rational function f is given by $f(x)=\frac{x^k(x-1)(x+3)}{x^5+2x-5}$, where k is a positive integer. For which of the following values of k will the graph of f have a horizontal asymptote at $y=0$?

(A) 2
(B) 3
(C) 4
(D) 5

50. The rational function r is given by $r(x)=\frac{(2x-3)(x-4)(x-2)}{(3x-1)(2x+1)(x-1)}$ and is equivalent to $r(x)=\frac{p(x)}{q(x)}$, where p and q are polynomial functions. Which of the following statements is true?

(A) The degree of p is less than the degree of q, and $\lim_{x \to \infty} r(x) = 0$.

(B) The degree of p is greater than the degree of q, and $\lim_{x \to \infty} r(x) = \infty$.

(C) The degree of p is equal to the degree of q, and $\lim_{x \to \infty} r(x) = 0$.

(D) The degree of p is equal to the degree of q, and $\lim_{x \to \infty} r(x) = \frac{1}{3}$.

51. The rational function h is expressed as the quotient of two polynomial functions f and g by $h(x) = \frac{f(x)}{g(x)}$. The function f is given by $f(x) = 6x^3 - x^2 + 60x - 25$. If the graph of h has a slant asymptote of $y = 2x - 1$, which of the following describes g ?

(A) g has degree 2 with leading coefficient 3.

(B) g has degree 2 with leading coefficient 12.

(C) g has degree 3 with leading coefficient 3.

(D) g has degree 4 with leading coefficient 12.

52. The rational function h is given by $h(x) = \frac{2x^5 + 5x^3 - 2x^2 - 13}{3x^2 - 2x + 7}$. Which of the following describes the end behavior of h ?

(A) As x increases without bound, $h(x)$ increases without bound, and as x decreases without bound, $h(x)$ decreases without bound.

(B) As x increases without bound, $h(x)$ increases without bound, and as x decreases without bound, $h(x)$ increases without bound.

(C) As x increases without bound, $h(x)$ decreases without bound, and as x decreases without bound, $h(x)$ increases without bound.

(D) As x increases without bound, $h(x)$ decreases without bound, and as x decreases without bound, $h(x)$ decreases without bound.

53. A polynomial function p has three distinct zeros each with multiplicity 1, and its leading coefficient is positive. The polynomial function q has exactly one zero with multiplicity 3, and its leading coefficient is negative. The rational function h can be written as the quotient of p and q by $h(x) = \frac{p(x)}{q(x)}$. Which of the following statements about h must be true?

(A) The graph of h has a horizontal asymptote at $y = 0$.

(B) The graph of h has a horizontal asymptote at $y = a$, where $a > 0$.

(C) The graph of h has a horizontal asymptote at $y = a$, where $a < 0$.

(D) The graph of h has no horizontal asymptote.

54.

x	$0 < x < 1$	$1 < x < 2$	$2 < x < 3$	$3 < x < 4$
Rate of change of f on the interval of x	Increasing	Positive and Constant	Decreasing	Negative and Constant

The table describes rates of change of a function f for selected intervals of x. The function f is defined for $0 \leq x \leq 4$. On which of the following intervals is the graph of f concave down?

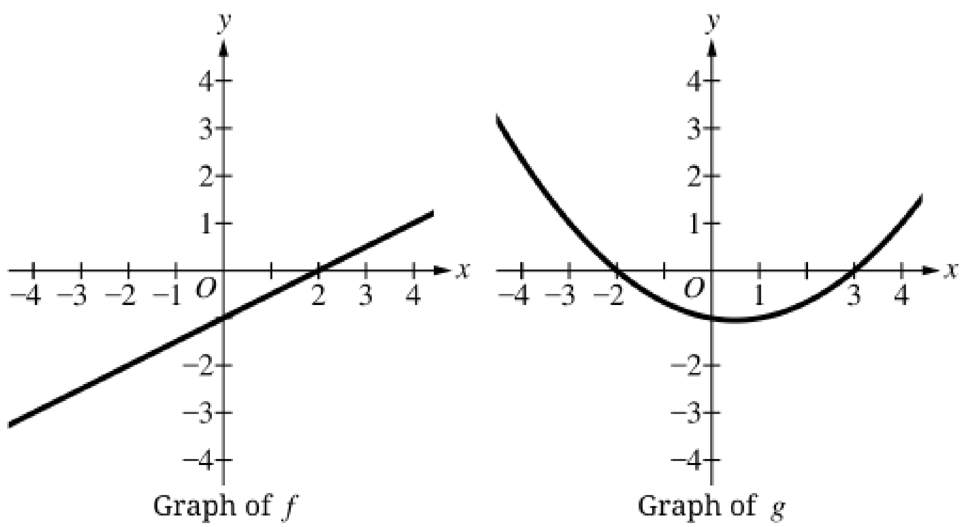
(A) $0 < x < 1$

(B) $1 < x < 2$

(C) $2 < x < 3$

(D) $3 < x < 4$

55.



The graphs of the polynomial functions f and g are shown. The function h is defined by $h(x) = \frac{f(x)}{g(x)}$. What are all vertical asymptotes of the graph of $y = h(x)$?

(A) $x = 2$ only

(B) $x = 3$ only

(C) $x = -2$ and $x = 3$ only

(D) $x = -2$, $x = 2$, and $x = 3$

56. The function g is given by $g(x) = x^3 - 3x^2 - 18x$, and the function h is given by $h(x) = x^2 - 2x - 35$. Let k be the function given by $k(x) = \frac{h(x)}{g(x)}$. What is the domain of k ?

(A) all real numbers x where $x \neq 0$

(B) all real numbers x where $x \neq -5, x \neq 7$

(C) all real numbers x where $x \neq -3, x \neq 0, x \neq 6$

(D) all real numbers x where $x \neq -5, x \neq -3, x \neq 0, x \neq 6, x \neq 7$

57. Let f be a rational function that is graphed in the xy-plane. Consider $x = 1$ and $x = 7$. The polynomial in the numerator of f has a zero at $x = 1$ and does not have a zero at $x = 7$. The polynomial in the denominator of f has zeros at both $x = 1$ and $x = 7$. The multiplicities of the zeros at $x = 1$ in the numerator and in the denominator are equal. Which of the following statements is true?

(A) The graph of f has holes at both $x = 1$ and $x = 7$.

(B) The graph of f has a vertical asymptote at $x = 1$ and a hole at $x = 7$.

(C) The graph of f has a hole at $x = 1$ and a vertical asymptote at $x = 7$.

(D) The graph of f has vertical asymptotes at both $x = 1$ and $x = 7$.

58. Which of the following functions has a zero at $x = 3$ and has a graph in the xy-plane with a vertical asymptote at $x = 2$ and a hole at $x = 1$?

(A) $h(x) = \frac{x^2-4x+3}{x^2-3x+2}$

(B) $j(x) = \frac{x^2-5x+6}{x^2-3x+2}$

(C) $k(x) = \frac{x-3}{x^2-3x+2}$

(D) $m(x) = \frac{x-3}{x^2-4x+3}$

59. Which of the following names a function with a hole in its graph at $x = 1$ and provides correct reasoning related to the hole?

(A) The graph of $f(x) = \frac{x^2-1}{x-1}$ has a hole at $(1, 2)$ because the values of $\frac{x^2-1}{x-1}$ get arbitrarily close to 2 for x-values sufficiently close to 1, but the function is undefined at $x = 1$.

(B) The graph of $g(x) = \frac{x^2+1}{x-1}$ has a hole at $x = 1$ because the values of $\frac{x^2+1}{x-1}$ increase without bound for x-values arbitrarily close to 1.

(C) The graph of $h(x) = \frac{4x-4}{x^2+1}$ has a hole at $(1, 0)$ because the values of $\frac{4x-4}{x^2+1}$ are arbitrarily close to 0 for x-values sufficiently close to 1.

(D) The graph of $k(x) = \frac{4x-4}{(x-1)^2}$ has a hole at $x = 1$ because the values of $4x - 4$ and $(x-1)^2$ are arbitrarily close to 0 for x-values sufficiently close to 1.

60. The rational function g is given by $g(x) = \frac{x^3+1000}{x^2-100} = \frac{(x+10)(x^2-10x+100)}{x^2-100}$. Which of the following statements describes the behavior of the graph of g ?

(A) The graph intersects the x-axis at $x = -10$ because $(-10)^3 + 1000 = 0$.

(B) The graph has a hole at $x = -10$ because $(x + 10)$ appears exactly once in the numerator and exactly once in the denominator, when both the numerator and the denominator of g are factored.

(C) The graph has vertical asymptotes at $x = 10$ and at $x = -10$ because $10^2 - 100 = 0$ and $(-10)^2 - 100 = 0$.

(D) The graph has no holes because the degree of the numerator is greater than the degree of the denominator.

61. In the xy-plane, the graph of a rational function f has a vertical asymptote at $x = -5$. Which of the following could be an expression for $f(x)$?

(A) $\frac{(x-5)(x+5)}{2(x-5)}$

(B) $\frac{(x-4)(x+5)}{(x-1)(x+5)}$

(C) $\frac{(x+1)(x+5)}{(x-5)(x+2)}$

(D) $\frac{(x-5)(x-3)}{(x-3)(x+5)}$

62. The rational function g is given by $g(x) = \frac{(x^2+3x)(x^2-4x-5)}{(x+3)(x-1)(x-2)}$. For what input values of g are the output values of g equal to 0 ?

(A) 0 only

(B) -1, 0, and 5 only

(C) -3, 1, and 2

(D) -3, -1, 0, and 5

63. The rational function r is given by $r(x) = \frac{x^3+4x^2+4x}{x^2-9}$. On what intervals of x is $r(x) \geq 0$?

(A) $x \geq 0$

(B) $-3 < x < 3$

(C) $-3 < x < -2$, $-2 < x < 0$, and $x > 3$ only

(D) $-3 < x \leq 0$ and $x > 3$

MCQ_Review_Unit_1

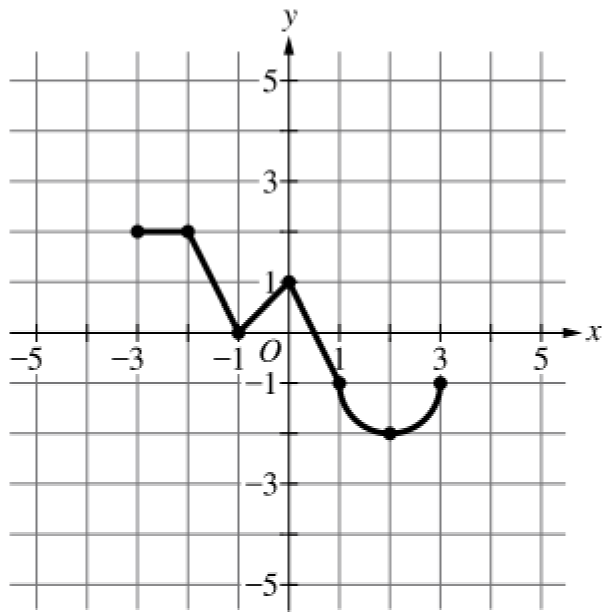
64.

x	-8	-4	-2	-1	0	3
$f(x)$	87	55	5	-4	-7	20

The table gives values for a polynomial function f at selected values of x. Let $g(x) = af(bx) + c$, where a, b, and c are positive constants. In the xy-plane, the graph of g is constructed by applying three transformations to the graph of f in this order: a horizontal dilation by a factor of 2, a vertical dilation by a factor of 3, and a vertical translation by 5 units. What is the value of $g(-4)$?

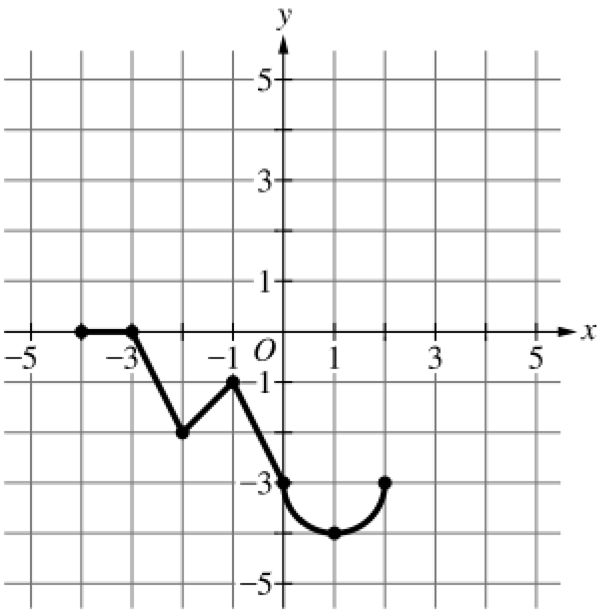
(A) 266
(B) 170
(C) 28
(D) 20

65.

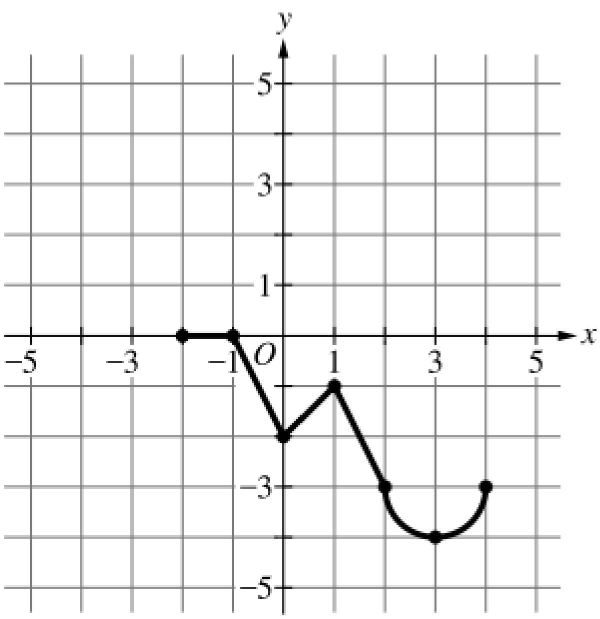


The graph of $y = f(x)$, consisting of four line segments and a semicircle, is shown for $-3 \leq x \leq 3$. Which of the following is the transformed graph for $y = f(x+1) - 2$?

(A)



(B)



(C)

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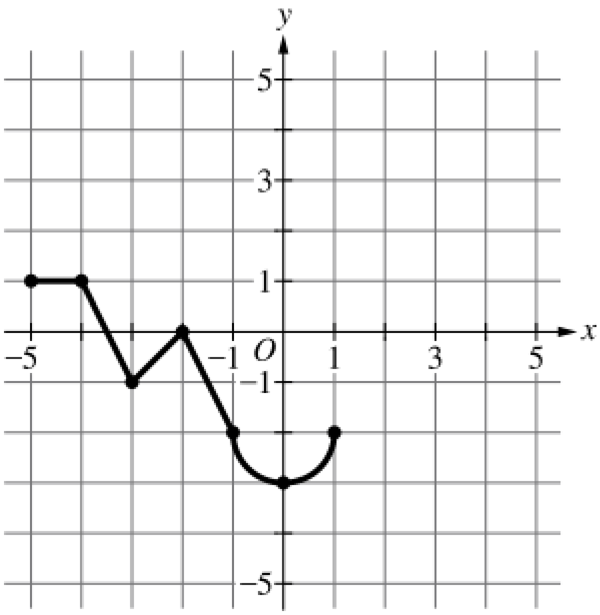
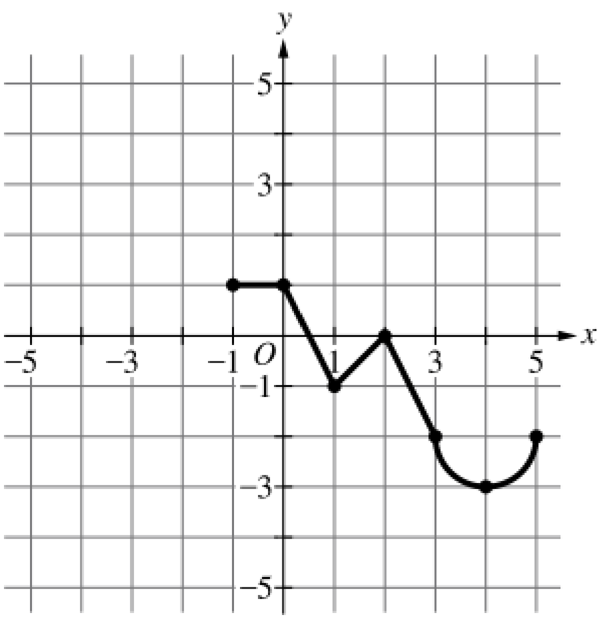


(D)



66. The polynomial function f is given by $f(x) = ax^4 + bx^3 + cx^2 + dx + k$, where $a \neq 0$ and b, c, d, and k are constants. Which of the following statements about f is true?

(A) f has both a global maximum and a global minimum.

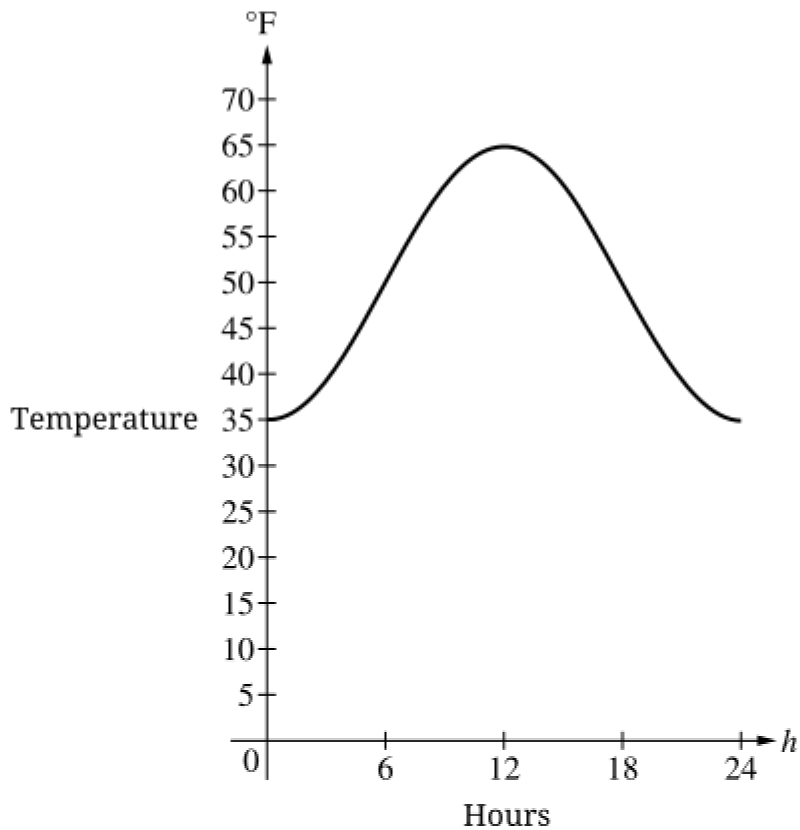
(B) f has either a global maximum or a global minimum, but not both.

(C) f has neither a global maximum nor a global minimum.

(D) The nature of a global maximum or a global minimum for f cannot be determined without more information about b, c, d, and k.

MCQ_Review_Unit_1

67.



Graph of T

During a month in a certain town, the temperature increases and decreases over the course of a day. A graph of the average temperatures during that month for any given day is shown. The data in the graph can be modeled by the function T, where $T(h)$ gives the temperature, in degrees Fahrenheit ($^\circ\mathrm{F}$), at time h hours after midnight. At a certain point in that month, there is an adjustment to clocks for daylight saving time, at which point clocks are adjusted 1 hour forward. For example, 6 a.m. instantly becomes 7 a.m. The function D models the same data as function T, after the shift to daylight saving time. If h still represents the number of hours after midnight, which of the following defines $D(h)$ in terms of T ?

(A) $D(h) = T(h+1)$

(B) $D(h) = T(h-1)$

(C) $D(h) = T(h)+1$

(D) $D(h) = T(h)-1$

68. The functions f and g are defined for all real numbers such that $g(x) = f(2(x-4))$. Which of the following sequences of transformations maps the graph of f to the graph of g in the same xy-plane?

(A) A horizontal dilation of the graph of f by a factor of 2, followed by a horizontal translation of the graph of f by -8 units

(B) A horizontal dilation of the graph of f by a factor of 2, followed by a horizontal translation of the graph of f by 8 units

(C) A horizontal dilation of the graph of f by a factor of $\frac{1}{2}$, followed by a horizontal translation of the graph of f by -4 units

(D) A horizontal dilation of the graph of f by a factor of $\frac{1}{2}$, followed by a horizontal translation of the graph of f by 4 units

69. The function f is given by $f(x) = x^2 + 2$. The function g is the result of a transformation of f and is given by $g(x) = \frac{x^2}{4} + 2$. Which of the following describes the transformation of the graph of f whose image is the graph of g ?

(A) A vertical dilation by a factor of $\frac{1}{4}$

(B) A horizontal dilation by a factor of $\frac{1}{2}$

(C) A horizontal dilation by a factor of 2

(D) A horizontal dilation by a factor of 4

70. The function f has domain $[-2, 2]$ and range $[1, 5]$. The function g is given by $g(x) = -2f(x + 3) + 4$. What are the domain and range of g ?

(A) domain: $[-5, -1]$, range: $[-6, 2]$

(B) domain: $[-5, -1]$, range: $[-2, 6]$

(C) domain: $[1, 5]$, range: $[-2, 6]$

(D) domain: $[1, 5]$, range: $[-6, 2]$

71.

x	0	1	2	3	4	5	6	7	8	9	10	11	12
$f(x)$	0	1	4	9	4	1	0	1	4	9	4	1	0
$g(x)$	0	2	2	0	2	2	0	2	2	0	2	2	0

The table gives values of the functions f and g for selected values of x. The pattern of the values of f and g continue, repeating every interval of width 6, for $0 \leq x \leq 48$. The graph of the function g is the result of a sequence of dilations of the graph of the function f. Which of the following could describe those dilations?

(A) A horizontal dilation by a factor of $\frac{1}{3}$ and a vertical dilation by a factor of $\frac{1}{2}$

(B) A horizontal dilation by a factor of $\frac{1}{2}$ and a vertical dilation by a factor of $\frac{1}{3}$

(C) A horizontal dilation by a factor of $\frac{1}{2}$ and a vertical dilation by a factor of $\frac{1}{2}$

(D) A horizontal dilation by a factor of 3 and a vertical dilation by a factor of 2

72. The function f is not explicitly given. In the xy-plane, the graph of the function g is the result of a sequence of transformations to the graph of f. The graph of g is the result of dilating the graph of f vertically by a factor of 2, then horizontally by a factor of 3, then translating the result up by 7 units, and then left by 11 units. Which of the following defines g in terms of f ?

(A) $g(x) = \frac{1}{3}f(2(x-7)) - 11$

(B) $g(x) = \frac{1}{2}f(3(x-11)) - 7$

(C) $g(x) = 2f\left(\frac{x+11}{3}\right) + 7$

(D) $g(x) = 3f\left(\frac{x+7}{2}\right) + 11$

73. The function f is given by $f(x) = x^4 - 3x^2 + 2$. In the xy-plane, the graph of the function g is a vertical translation of the graph of the function f downward by 3 units. Which of the following defines g ?

(A) $g(x) = x^4 - 3x^2 - 1$

(B) $g(x) = x^4 - 3x^2 + 5$

(C) $g(x) = (x-3)^4 - 3(x-3)^2 + 2$

(D) $g(x) = (x+3)^4 - 3(x+3)^2 + 2$

74.

Interval (in seconds)	0 to 6	6 to 12	12 to 18	18 to 24	24 to 30
Drone A	$+17$	-4	$+11$	-5	-3
Drone B	$+5$	$+3$	$+3$	$+2$	$+3$

Two drones are flying over a given area, and their heights above the ground are changing. The table gives the change in height, in feet, for the drones over successive 6-second intervals. Which of the following is true about the average rates of change for drone A and drone B over the time interval from $t = 0$ seconds to $t = 30$ seconds?

(A) The average rates of change are equal.
(B) The average rate of change for drone A is greater than for drone B.
(C) The average rate of change for drone B is greater than for drone A.
(D) The average rates of change cannot be determined because changes in heights are given, not heights of the drones.

75. The graph of which of the following functions in the xy-plane has at least one x-intercept, at least one hole, at least one vertical asymptote, and a horizontal asymptote?

(A) $f(x) = \frac{x^2-16}{x^2-x-6}$
(B) $f(x) = \frac{x^2-16}{x^2-x-30}$
(C) $f(x) = \frac{x^2-4}{x^2-x-30}$
(D) $f(x) = \frac{x^2-4}{x^2-x-6}$

76. The polynomial function k is given by $k(x) = ax^4 - bx^3 + 15$, where a and b are nonzero real constants. Each of the zeros of k has multiplicity 1. In the xy-plane, an x-intercept of the graph of k is $(17.997,0)$. A zero of k is $-0.478 - 0.801i$. Which of the following statements must be true?

(A) The graph of k has three x-intercepts.
(B) $-0.478 + 0.801i$ is a zero of k.
(C) The equation $k(x) = 0$ has four real solutions.
(D) The graph of k is tangent to the x-axis at $x = 17.997$.

77. A polynomial function p is given by $p(x) = -x(x-4)(x+2)$. What are all intervals on which $p(x) \geq 0$?

(A) $[-2,4]$
(B) $[-2,0] \cup [4,\infty)$
(C) $(-\infty,-4] \cup [0,2]$
(D) $(-\infty,-2] \cup [0,4]$

78. For the polynomial function g, the rate of change of g is increasing for $x < 2$ and decreasing for $x > 2$. Which of the following must be true?

(A) The graph of g has a minimum at $x = 2$.
(B) The graph of g has a maximum at $x = 2$.
(C) The graph of g has a point of inflection at $x = 2$, is concave down for $x < 2$, and is concave up for $x > 2$.
(D) The graph of g has a point of inflection at $x = 2$, is concave up for $x < 2$, and is concave down for $x > 2$.