Passport to Advanced Math Drill 1

For each question in this section, solve the problem and circle the letter of the answer that you think is the best of the choices given.

1. Polymerase chain reaction is a technique used to copy a portion of DNA. An enzyme is added to a sample of DNA. The resulting mixture is then subjected to a cycle of temperatures. During each cycle, each strand of DNA is copied, resulting in twice the number of strands in the mixture. Which of the following equations accurately represents the resulting number of strands in a sample with s initial strands after c temperature cycles?

   A) s^c
   B) $s(2^{c-1})$
   C) $s(2^c)$
   D) sc

2. What is the vertex of the parabola defined by the equation $y = x^2 + 4x - 12$?

   A) $(0, -12)$
   B) $(-6, 0)$
   C) $(-2, -16)$
   D) $(2, -12)$

3. At launch, a space shuttle achieves an acceleration of 3 g (where $g = 9.8$ m/s^2). Which of the following functions, f, represents how far the space shuttle has traveled, in meters, after t seconds of accelerating at this rate?

   (Note: to find displacement, use the equation $s = \frac{1}{2}at^2$, where a is acceleration and t is time elapsed.)

   A) $f(t) = 3t$
   B) $f(t) = 29.4t^2$
   C) $f(t) = 14.7t^2$
   D) $f(t) = 9.8t^2$

4. The vertex form of a parabola's equation is $y = (x - h)^2 + k$, where point (h, k) is the vertex of the parabola. What is the vertex form of the parabola represented by the standard form equation $y = x^2 - 2x + 8$?

   A) $y = (x - 1)^2 + 7$
   B) $y = (x + 1)^2 + 11$
   C) $y = (x - 1)^2 + 8$
   D) $y = (x - 4)^2$

5. Bacteria grow asexually by a single bacterium dividing into two bacteria. These bacteria can themselves divide again and again. Assume a petri dish contains a single bacterium that divides exactly once per hour. Which of the following functions, $f(t)$, represents the number of bacteria in the petri dish after t hours?

A) $f(t) = 2t$
B) $f(t) = 2^t$
C) $f(t) = (t+1)^2$
D) $f(t) = t^2$

6. Which of the following accurately expresses $3^{\frac{t}{2}+1} \cdot 5^{1-\frac{t}{2}}$ in the form $A \cdot B^t$?

A) $15 \cdot \left(\sqrt{\frac{3}{5}}\right)^t$

B) $15 \cdot \left(\frac{15}{4}\right)^t$

C) $\sqrt{\frac{3}{5}} \cdot 15^t$

D) $15 \cdot \left(\sqrt{15}\right)^t$

Passport to Advanced Math Drill 2

For each question in this section, solve the problem and circle the letter of the answer that you think is the best of the choices given.

1. Cube A has a volume of 3 ft^3. Cube B has a volume of 9 ft^3. Which of the following expresses the ratio of the side length of cube A to the side length of cube B?

   A) $3^{\frac{1}{2}} : 3^2$
   B) $3 : 3^{\frac{2}{3}}$
   C) $3^{\frac{1}{3}} : 3^{\frac{2}{3}}$
   D) $3^3 : 3^5$

2. $2x^3 + 4x^2 + 2x =$

   A) $2x(x-1)^2$
   B) $2(x+1)^3$
   C) $2x(x+1)^2$
   D) $x(x+2)^2$

3. $4x^2 + 12x + 14 =$

   A) $(2x+6)^2 - 18$
   B) $(2x+3)^2 + 5$
   C) $(4x+3)^2 + 5$
   D) $(2x-3)^2 + 5$

4. The standard form of the equation of a circle is $(x-h)^2 + (y-k)^2 = r^2$, where the center of the circle is at point (h, k) and the radius of the circle is r. What is the standard form of the equation of the circle defined by the equation $x^2 + y^2 - 6x + 8y = 0$?

   A) $(x-6)^2 + (y+8)^2 = 0$
   B) $(x+3)^2 + (y+4)^2 = 25$
   C) $(x-3)^2 + (y+4)^2 = 25$
   D) $(x-3)^2 + (y+4)^2 = 5$

5. $x^{\frac{2}{3}}+8y^{\frac{5}{3}}=$

A) $\sqrt[3]{x^2+8y^5}$

B) $\sqrt[3]{x^2+512y^5}$

C) $\sqrt[3]{x^2}+\sqrt[3]{512y^5}$

D) $\sqrt[3]{x^2+2y^5}$

6. Which of the following expressions is NOT equal to $4x^2-32x+64$?

A) $4(x^2-8x+16)$
B) $(2x-8)^2$
C) $4(x+4)(x-4)$
D) $4(x-4)^2$

7. Which of the following is equivalent to $x^{24}-18x^{12}+82$?

A) $(x^{12}-x^6\sqrt{18})^2+82$
B) $x^{24}+18x^{12}-18x^{12}+82$
C) $(x^{12}-9)^2+1$
D) $(x^2-9)^{12}+1$

8. Which of the following accurately rewrites the expression $\frac{5\cdot 3^{2t-1}}{6\cdot 2^{t+1}}$ in the form $A\cdot B^t$?

A) $\frac{5}{6}\cdot\left(\frac{9}{2}\right)^t$

B) $\frac{5}{4}\cdot\left(\frac{9}{2}\right)^t$

C) $\frac{5}{36}\cdot\left(\frac{3}{2}\right)^t$

D) $\frac{5}{36}\cdot\left(\frac{9}{2}\right)^t$

Passport to Advanced Math Drill 3

This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

1. If $x^2 - 12x = -11$, and $x > 1$, then $x =$

2. What is the positive difference between the roots of the equation $(x + 1)^2 = 16$?

   A) 2
   B) 5
   C) 8
   D) 16

3. $[x^3 - 2x + 3] + [2x^2 + 2x - 4] =$

   A) $x^3 - 2x^2 - 4x + 7$
   B) $x^3 + 2x^2 - 1$
   C) $2x^5 + 2x^4 - 8x^3 + 10x^2 + 14x - 12$
   D) $3x^2 - 1$

4. For which value of c does the equation $2x^2 + c = 8x$ have exactly 1 value for x?

   A) -8
   B) 0
   C) 2
   D) 8

5. If $7x + 3 = -x^2$, then $x =$

A) $\frac{-7 \pm \sqrt{61}}{-2}$

B) $\frac{-7 \pm \sqrt{37}}{2}$

C) $\frac{-3 \pm \sqrt{-19}}{14}$

D) $\frac{3 \pm \sqrt{37}}{2}$

6. $(5z^8 - 2z^3 + z) - (-4z^4 + 2z^3 + z) =$

A) $5z^8 + 4z^4$

B) $5z^8 - 4z^4 + 2z$

C) $5z^8 - 4z^4 - 4z^3 + 2z$

D) $5z^8 + 4z^4 - 4z^3$

Passport to Advanced Math Drill 4

This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

1. If $\frac{x^2+3x-10}{x-2}=3$, then $x=$

   A) -5
   B) -4
   C) -2
   D) 2

2. If $\sqrt[3]{x+3}=2$, then $x=$

   A) 5
   B) 1
   C) -1
   D) -3

3. Which of the following is an actual solution to the equation $\sqrt{x+7}-x=1$?

   A) -3
   B) -2
   C) 2
   D) 3

4. If $\frac{x^2-x}{x+4}=\frac{x+24}{x+4}$, then what is the value of x?

5. Which of the following most completely expresses the solution set of the equation $\frac{x+12}{x-3} = \frac{x^2}{x-3}$?

A) $x = -4$
B) $x = -4, 3$
C) $x = -3, 4$
D) $x = 4$

Passport to Advanced Math Drill 5

This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

1. If $x - y = 3$, then $x^2 - 2xy + y^2 =$

2. $(2x - 3)(x + 4) =$

   A) $2x^2 + 5x - 12$
   B) $2x^2 + x - 12$
   C) $2x^2 + 11x + 12$
   D) $3x + 1$

3. If $x^2 - y^2 = 18$, and $x + y = 3$, then $y - x =$

   A) -6
   B) -3
   C) 3
   D) 6

4. If $x + y = 7$ and $x^2 + y^2 = 42$, then $xy =$

   A) 49
   B) 7
   C) 3.5
   D) -7

5. Where defined, $\frac{36x^7+36x^4}{48x^6+24x^4} =$

A) $\frac{3x+9}{10}$

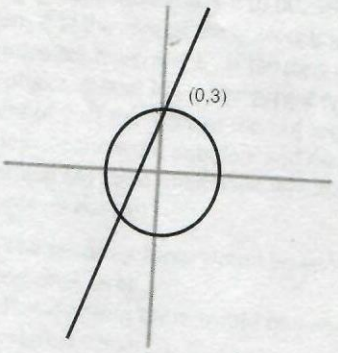
B) $\frac{36x^{11}}{24(2+x^{10})}$

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

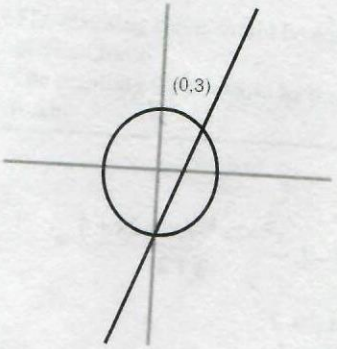
D) $\frac{3(x^7+x^4)}{2(2x^3+x^2)^2}$

6. Which of the following graphs could be used to solve the system of equations $y = 2x + 3$ and $x^2 + y^2 = 9$?

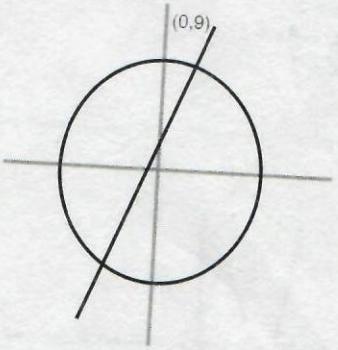
A)



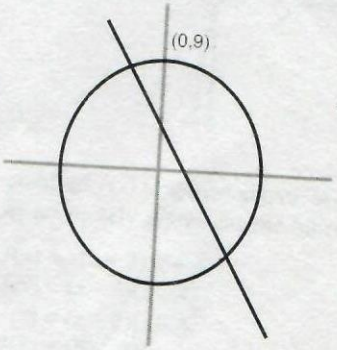
B)



C)



D)



7. Where defined, $\frac{x^4-7x^3+21x^2-30x+18}{x^2-4x+6} =$

A) x^2-3x+3
B) $x^2-11x+17$
C) $x^4-7x^3+31.5$
D) x^2-3x-3

8. When $x \neq -2$, $\frac{x^4-2x^3-8x^2+2x+4}{x+2} =$

A) x^3-4x^2+2
B) x^3-8x+5
C) x^3-2x^2-8x+1
D) x^3-4x+2

9. If $x^2-y^2=13$ and $x-y=12$, then $x=$

A) $\frac{157}{24}$

B) $\frac{131}{12}$

C) $\frac{157}{12}$

D) $\frac{13}{12}$

Passport to Advanced Math Drill 6

For each question in this section, solve the problem and circle the letter of the answer that you think is the best of the choices given.

1. The standard form of a quadratic equation is $y = ax^2 + bx + c = 0$. Which of the following must be true of the graph of a quadratic equation when $a < 0$?

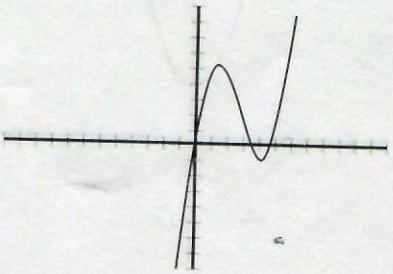
   A) The parabola graphed opens downwards.
   B) The parabola graphed opens upwards.
   C) There are two x-intercepts.
   D) The slope of the graph is undefined for all values of x.

2. The function $f(x)$ (not shown) has $(x + 2)$ as one of its factors. Which of the following must be true about the graph of $f(x)$?

   A) $f(x)$ includes the point (2,0)
   B) $f(x)$ includes the point (0,2)
   C) $f(x)$ includes the point $(-2, 0)$
   D) $f(x)$ includes the point $(0, -2)$

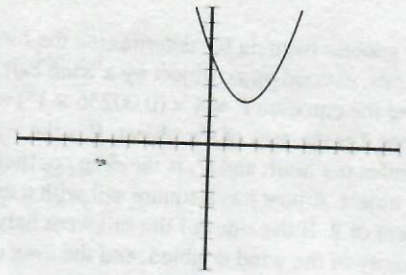
3. The generic formula for determining the force, F, in pounds, exerted on an object by a wind can be found using the equation $F = A \times (0.00256 \times V^2) \times C_d$, where A is the area of the object, V is the windspeed in miles per hour, and C_d is the drag coefficient of the object. A boat has a square sail with a drag coefficient of 2. If the sides of the sail were halved, the velocity of the wind doubled, and the drag coefficient remained the same, then what would be the change in force on the sail?

   A) The resulting force would be one-quarter the original force.
   B) The resulting force would be one-half the original force.
   C) The resulting force would be equal to the original force.
   D) The resulting force would be double the original force.



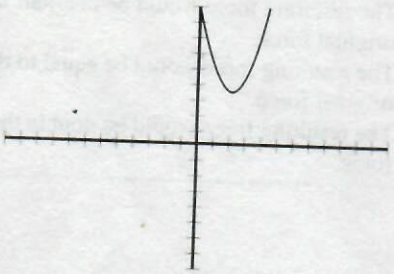
4. The graph of $f(x)$ is shown above. Which of the following accurately represents the function $f(x)$?

   A) $f(x) = x(x + 3)(x + 4)$
   B) $f(x) = (x - 3)(x - 4)$
   C) $f(x) = (x + 3)(x - 4)$
   D) $f(x) = x(x - 3)(x - 4)$

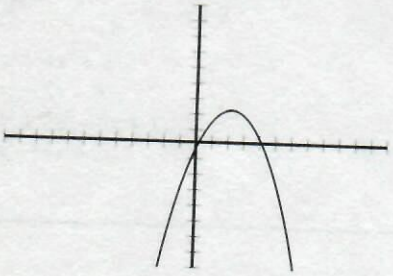


5. The equation $y = (x - 2)^2 + 3$ is shown in the graph above. Which of the following shows the graph of $y = 2(x - 2)^2 + 3$?

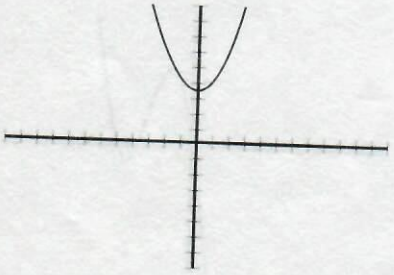
A)



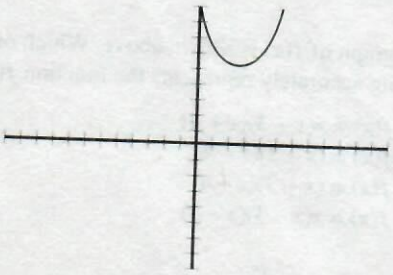
B)



C)



D)

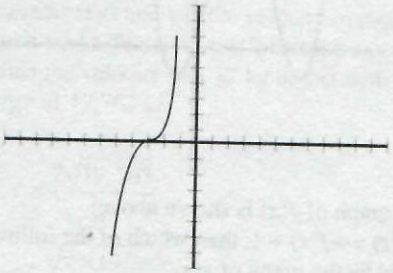


6. The graph of the function $f(x)$ contains the points $(-2, 0)$, $(\frac{5}{2}, 0)$, and $(3, 0)$. Which of the following could be f?

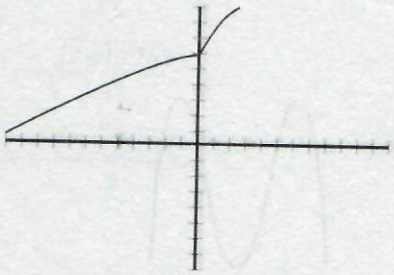
A) $f(x) = 2x^3 + 3x^2 - 17x + 30$
B) $f(x) = 2x^3 - 7x^2 - 7x + 30$
C) $f(x) = 2x^3 + 7x^2 - 7x - 30$
D) $f(x) = 2x^3 + 3x^2 - 17x - 30$

7. The value of the function f at every point x is the sum of the cube of x, x, and 3. Which of the following could be the graph of $f(x)$?

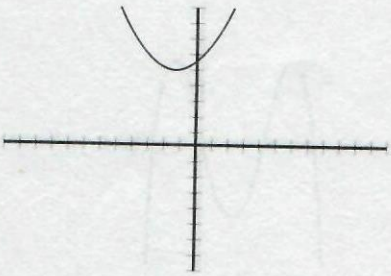
A)



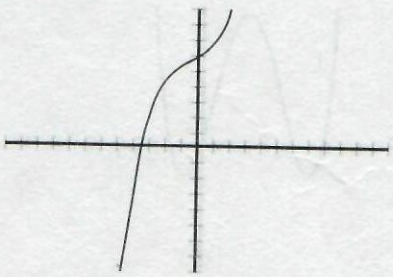
B)



C)



D)



Passport to Advanced Math Drill 7

For each question in this section, solve the problem and circle the letter of the answer that you think is the best of the choices given.

1. If $f(x) = 0.5x^3 - 4x^2 + x - 2$, then $f(2) =$

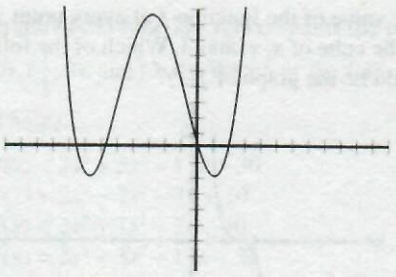
   A) -12
   B) -8
   C) -4
   D) 16

2. Jerry borrows x dollars against a line of credit and y dollars against his credit card. Jerry models his initial debt as follows:
   $x + y = 10{,}000$

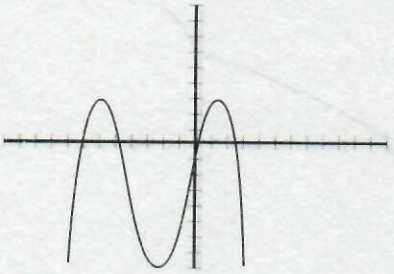
   Jerry continues to use his line of credit and his credit card, paying back the debt when his finances allow. Six months later, Jerry's debt can be modeled as follows:
   $1.24x + 0.76y = 10{,}480$

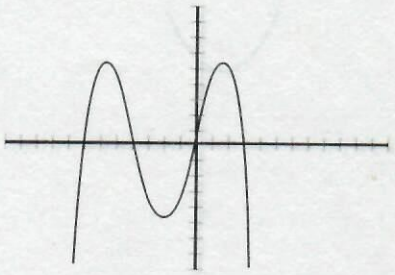
   Which of the following must be true?

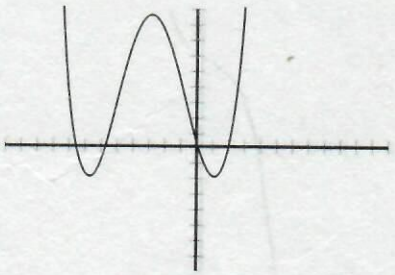
   A) The amount Jerry owes on his line of credit increased over the six month period.
   B) The amount Jerry owes on his credit card increased over the six month period.
   C) Initially, Jerry borrowed the same amount against his line of credit as he borrowed against his credit card.
   D) After six months Jerry owed more on his credit card than on his line of credit.

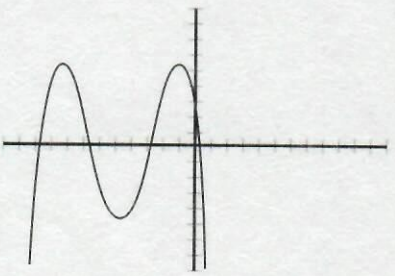


3. The graph of $f(x)$ is shown above.
   If $g(x) = -f(x) + 1$, then which of the following could be the graph of $g(x)$?

   A)
   

   B)
   

   C)
   

   D)
   

4. Kinetic energy, K, in Joules (J), can be found using the equation $K = \frac{1}{2}mv^2$, where m is the mass in kilograms (kg) and v is the velocity in meters per second (m/s). Which of the following equations represents the velocity of a 17 kg object with a kinetic energy of 19,763 J?

A) $v = \frac{2\sqrt{19,763}}{17}$

B) $v = \frac{\sqrt{2 \times 19,763}}{17}$

C) $v = \sqrt{\frac{2 \times 19,763}{17}}$

D) $v = \frac{\sqrt{17 \times 19,763}}{2}$

5. The value of $1 + \left(-\frac{3}{5}\right) + \left(-\frac{3}{5}\right)^2 + \left(-\frac{3}{5}\right)^3 + \left(-\frac{3}{5}\right)^4$ can be determined using the equation $s = \frac{1}{1 - \left(-\frac{3}{5}\right)}$, where s is the sum of the infinite geometric sequence with a common ratio less than 1. Which of the following equations could be used to determine the value of $1 + \frac{3}{4} + \frac{9}{16} + \frac{27}{64} + \frac{81}{256}$?

A) $s = \frac{1}{1 - \frac{1}{4}}$

B) $s = \frac{1}{1 - \frac{3}{4}}$

C) $s = \frac{1}{1 + \frac{3}{4}}$

D) $s = \frac{\frac{3}{4}}{1 - \frac{3}{4}}$