32 If $i = \sqrt{-1}$, then $4i(6i) =$

A  48  
B  24  
C  −24  
D  −48  

33 What is an equivalent form of $\frac{2}{3 + i}$?

A  $\frac{3 - i}{4}$  
B  $\frac{3 - i}{5}$  
C  $\frac{4 - i}{4}$  
D  $\frac{4 - i}{5}$  

34 What is the product of the complex numbers $(3 + i)$ and $(3 - i)$?

A  8  
B  10  
C  $9 - i$  
D  $10 - 6i$  

35 If $i = \sqrt{-1}$ and $a$ and $b$ are non-zero real numbers, what is $\frac{1}{a + bi}$?

A  $\frac{a + bi}{a^2 + b^2}$  
B  $\frac{a - bi}{a^2 + b^2}$  
C  $\frac{a + bi}{a^2 - b^2}$  
D  $\frac{a - bi}{a^2 - b^2}$  

36 Which expression represents $(-3 - 2i) - (-5 + i)$?

A  $-8 - 3i$  
B  $-8 - i$  
C  $2 - i$  
D  $2 - 3i$  

37 What is the sum of the complex numbers $(12 - 5i)$ and $(-3 + 4i)$?

A  $9 - i$  
B  $15 - 9i$  
C  $-16 + 63i$  
D  $9 - 9i$  

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38. What are the solutions to the equation \( x^2 + 2x + 2 = 0 \)?

A. \( x = 0; x = -2 \)
B. \( x = 0; x = -2i \)
C. \( x = -1 + i; x = -1 - i \)
D. \( x = -1 + 2\sqrt{2}; x = -1 - 2\sqrt{2} \)

39. What are the solutions to the equation \( 1 + \frac{1}{x^2} = \frac{3}{x} \)?

A. \( x = \frac{3}{2} + \frac{\sqrt{5}}{2}; x = \frac{3}{2} - \frac{\sqrt{5}}{2} \)
B. \( x = 3 + \frac{\sqrt{5}}{2}; x = 3 - \frac{\sqrt{5}}{2} \)
C. \( x = \frac{3}{2} + \frac{\sqrt{13}}{2}; x = \frac{3}{2} - \frac{\sqrt{13}}{2} \)
D. \( x = 3 + \frac{\sqrt{13}}{2}; x = 3 - \frac{\sqrt{13}}{2} \)

40. There are two numbers with the following properties.

1) The second number is 3 more than the first number.
2) The product of the two numbers is 9 more than their sum.

Which of the following represents possible values of these two numbers?

A. \(-6, -3\)
B. \(-4, -1\)
C. \(-1, 4\)
D. \(-3, 6\)

41. Jenny is solving the equation \( x^2 - 8x = 9 \) by completing the square. What number should be added to both sides of the equation to complete the square?

A. \(2\)
B. \(4\)
C. \(8\)
D. \(16\)
42 Two consecutive positive integers have the property that one integer times twice the other equals 612. What is the sum of these two integers?

A 33  
B 35  
C 37  
D 39

43 What are the solutions to the equation $x^2 - 6x + 5 = -8$?

A 2 and 3  
B 2i and 3i  
C $3 + 2\cdot 3$ and $3 - 2\cdot 3$  
D $3 + 2i$ and $3 - 2i$

45 Which of the following sentences is true about the graphs of $y = 3(x - 5)^2 + 1$ and $y = 3(x + 5)^2 + 1$?

A Their vertices are maximums.  
B The graphs have the same shape with different vertices.  
C The graphs have different shapes with different vertices.  
D One graph has a vertex that is a maximum, while the other graph has a vertex that is a minimum.

46 What are the $x$-intercepts of the graph of $y = 12x^2 - 5x - 2$?

A $1$ and $-\frac{1}{6}$  
B $-1$ and $\frac{1}{6}$  
C $\frac{2}{3}$ and $-\frac{1}{4}$  
D $-\frac{2}{3}$ and $\frac{1}{4}$

---

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47 Which is the graph of \( y = -2(x-1)^2 + 1 \)?

A

B

C

D
48. Which ordered pair is the vertex of \( f(x) = x^2 + 6x + 5 \)?

A. \((-3, -4)\)
B. \((-2, -3)\)
C. \((-1, 0)\)
D. \((0, -5)\)

49. The graph of \( \left( \frac{x}{2} \right)^2 - \left( \frac{y}{3} \right)^2 = 1 \) is a hyperbola.

Which set of equations represents the asymptotes of the hyperbola’s graph?

A. \( y = \frac{3}{2}x, y = -\frac{3}{2}x \)
B. \( y = \frac{2}{3}x, y = -\frac{2}{3}x \)
C. \( y = \frac{1}{2}x, y = -\frac{1}{2}x \)
D. \( y = \frac{1}{3}x, y = -\frac{1}{3}x \)

50. Which of the following represents a parabola?

A. \( x^2 + y^2 = r^2 \)
B. \( \frac{y^2}{a^2} + \frac{x^2}{b^2} = 1 \)
C. \( 4px = y^2 \)
D. \( \frac{x^2}{a^2} - \frac{x^2}{b^2} = 1 \)

51. \( 4x^2 - 5y^2 - 16x - 30y - 9 = 0 \)

What is the standard form of the equation of the conic given above?

A. \( \frac{(x - 4)^2}{11} - \frac{(y - 3)^2}{4} = 1 \)
B. \( \frac{(y + 3)^2}{4} - \frac{(x - 2)^2}{5} = 1 \)
C. \( \frac{(y - 3)^2}{6} - \frac{(x + 2)^2}{9} = 1 \)
D. \( \frac{(x - 4)^2}{11} + \frac{(y - 3)^2}{4} = 1 \)
52 Which statement describes the graph of the equation $x^2 + y^2 + 4x - 6y - 3 = 0$?

A. a hyperbola with center $(-2, 3)$ and vertices $(4, -3)$ and $(-4, 3)$
B. a hyperbola with center $(-2, 3)$ and vertices $(2, -3)$ and $(3, -2)$
C. a circle with center $(-2, 3)$ and radius 8
D. a circle with center $(-2, 3)$ and radius 4

53 What is the solution to the equation $5^x = 17$?

A. $x = 2$
B. $x = \log_{10} 2$
C. $x = \log_{10} 17 + \log_{10} 5$
D. $x = \dfrac{\log_{10} 17}{\log_{10} 5}$

54 If $\log_{10} x = -2$, what is the value of $x$?

A. $x = -\sqrt{10}$
B. $x = \sqrt{10}$
C. $x = \dfrac{1}{100}$
D. $x = 100$

55 Which equation is equivalent to $\log_3 \dfrac{1}{9} = x$?

A. $\dfrac{1}{9} = x^3$
B. $\left(\dfrac{1}{9}\right)^3 = x$
C. $3^x = \dfrac{1}{9}$
D. $3^x = \dfrac{1}{9}$

56 If $\log x = 2$, which of the following is true?

A. $y = x^2$
B. $y = 2x$
C. $x = y^2$
D. $x = 2y$

57 Which is the first incorrect step in simplifying $\log_4 \dfrac{4}{64}$?

Step 1: $\log_4 \dfrac{4}{64} = \log_4 4 - \log_4 64$
Step 2: $= 1 - 16$
Step 3: $= -15$

A. Step 1
B. Step 2
C. Step 3
D. Each step is correct.
Jeremy, Michael, Shanan, and Brenda each worked the same math problem at the chalkboard. Each student’s work is shown below. Their teacher said that while two of them had the correct answer, only one of them had arrived at the correct conclusion using correct steps.

Jeremy's work

\[
x^3 x^{-7} = \frac{x^3}{x^{-7}} = x^{10}, \ x \neq 0
\]

Shanan's work

\[
x^3 x^{-7} = \frac{x^3}{x^7} = \frac{1}{x^4}, \ x \neq 0
\]

Michael's work

\[
x^3 x^{-7} = \frac{x^3}{x^{-7}} = x^{-4}, \ x \neq 0
\]

Brenda's work

\[
x^3 x^{-7} = \frac{x^3}{x^7} = x^4, \ x \neq 0
\]

Which is a completely correct solution?

A. Jeremy’s work
B. Michael’s work
C. Shanan’s work
D. Brenda’s work

A student showed the following steps in his solution of the equation below, but his answer was not correct.

\[
\log_5 (2x^2 - 3x + 1) - \log_5 (x - 1) + \log_5 125 = 6
\]

Step 1:

\[
\log_5 (2x - 1)(x - 1) - \log_5 (x - 1) + 3 = 6
\]

Step 2:

\[
\log_5 (2x - 1)(x - 1) - \log_5 (x - 1) = 3
\]

Step 3: \( \log_5 (x - 1) = 3 \)

Step 4: \( x - 1 = 125 \)

Step 5: \( x = 126 \)

In which step did he make his first error?

A. Step 1
B. Step 2
C. Step 3
D. Step 4

Which is the first incorrect step in simplifying \((x^2)^3 - (x^5)^{-1}\)?

Step 1: \((x^2)^3 - (x^5)^{-1} = x^6 - \frac{1}{x^5}

Step 2:

\[
= x^6 - \frac{1}{x^5}
\]

Step 3:

\[
= \frac{x^6}{x^5}
\]

Step 4:

\[
= x
\]

A. Step 1
B. Step 2
C. Step 3
D. Step 4
61. A certain radioactive element decays over time according to the equation 
\[ y = A \left( \frac{1}{2} \right)^{\frac{t}{300}} \],
where \( A \) = the number of grams present initially and \( t \) = time in years. If 1000 grams were present initially, how many grams will remain after 900 years?

A. 500 grams  
B. 250 grams  
C. 125 grams  
D. 62.5 grams

62. Bacteria in a culture are growing exponentially with time, as shown in the table below.

<table>
<thead>
<tr>
<th>Day</th>
<th>Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>200</td>
</tr>
<tr>
<td>2</td>
<td>400</td>
</tr>
</tbody>
</table>

Which of the following equations expresses the number of bacteria, \( y \), present at any time, \( t \)?

A. \( y = 100 + 2^t \)  
B. \( y = (100) \cdot (2)^t \)  
C. \( y = 2^t \)  
D. \( y = (200) \cdot (2)^t \)

63. If the equation \( y = 2^x \) is graphed, which of the following values of \( x \) would produce a point closest to the \( x \)-axis?

A. \( \frac{1}{4} \)  
B. \( \frac{3}{4} \)  
C. \( \frac{5}{3} \)  
D. \( \frac{8}{3} \)

64. Which table below correctly describes points of the exponential function \( f(x) = 3^{-x} - 2 \)?

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>-2</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>-18</td>
<td>-6</td>
<td>-2</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>-4</td>
<td>-5</td>
<td>-2</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>(-\frac{8}{9})</td>
<td>(-\frac{2}{3})</td>
<td>-1</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>7</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Algebra II

**Released Test Questions**

**65** In 1997 the population of a small town was 700. If the annual rate of increase is about 0.8%, which value below expresses the population five years later?

A. \(5(700)(0.008)\)
B. \(5(700)(1.008)\)
C. \((700)(0.008)^5\)
D. \((700)(1.008)^5\)

---

**66** \(\log_6 40 = \)

A. \(\log_{10} 6 + \log_{10} 40\)
B. \(\log_{10} 6 - \log_{10} 40\)
C. \((\log_{10} 6)(\log_{10} 40)\)
D. \(\frac{\log_{10} 40}{\log_{10} 6}\)

---

**67** Jonathan wrote the equation \(\log_6 (x - 4) = 0\) on the board. He needs one clue for problem solving. Which fact provides the correct information that he needs to solve the equation?

A. \(6^0 = 1\)
B. \(6^1 = 6\)
C. \(4 - 4 = 0\)
D. \(6 - 4 = 2\)

### Additional Questions

**68** What is the value of \(\log_3 27\)?

A. 2
B. 3
C. 6
D. 9

**69** If \(\log 2 \approx 0.301\) and \(\log 3 \approx 0.477\), what is the approximate value of \(\log 72\)?

A. 0.051
B. 0.778
C. 0.861
D. 1.857

**70** Which of the following is a simplified form of the expression \(\log_{21} 5 + \log_{21} 4 - \log_{21} 2\)?

A. \(\log_{21} 10\)
B. \(\log_{10} 21\)
C. \(\log_{21} 7\)
D. \(\log_7 21\)

**71** If \(x\) is a real number, for what values of \(x\) is the equation \(\frac{3x - 9}{3} = x - 3\) true?

A. all values of \(x\)
B. some values of \(x\)
C. no values of \(x\)
D. impossible to determine
On a recent test, Jeremy wrote the equation \(
\frac{x^2 - 16}{x - 4} = x + 4
\). Which of the following statements is correct about the equation he wrote?

A. The equation is always true.
B. The equation is always true, except when \(x = 4\).
C. The equation is never true.
D. The equation is sometimes true when \(x = 4\).

Given the equation \(y = x^n\) where \(x > 0\) and \(n < 0\), which statement is valid for real values of \(y\)?

A. \(y > 0\)
B. \(y = 0\)
C. \(y < 0\)
D. \(y \leq 0\)

If \(x\) is a real number, which best describes the values of \(x\) for which the inequality \(\sqrt{x} > 0\) is true?

A. all \(x > 0\)
B. all \(x \geq 0\)
C. all values of \(x\)
D. no values of \(x\)

Which of the following conclusions is true about the statement below?

\[x^2 = \sqrt{x}\]

A. The statement is always true.
B. The statement is true when \(x\) is negative.
C. The statement is true when \(x = 0\).
D. The statement is never true.

If \(x\) is a real number, for what values of \(x\) is the equation \(\log_5 5^x = x\) true?

A. all values of \(x\)
B. some values of \(x\)
C. no values of \(x\)
D. impossible to determine

Abelardo wants to create several different 7-character screen names. He wants to use arrangements of the first 3 letters of his first name (abe), followed by arrangements of 4 digits in 1984, the year of his birth. How many different screen names can he create in this way?

A. 72
B. 144
C. 288
D. 576
A train is made up of a locomotive, 7 different cars, and a caboose. If the locomotive must be first, and the caboose must be last, how many different ways can the train be ordered?

A 5040  
B 181,440  
C 362,880  
D 823,543

There are 12 candidates in a city election. The winner will be the mayor, and the runner-up will be the vice-mayor. How many different combinations of mayor and vice-mayor are possible?

A 22  
B 24  
C 132  
D 144

Teresa and Julia are among 10 students who have applied for a trip to Washington, D.C. Two students from the group will be selected at random for the trip. What is the probability that Teresa and Julia will be the 2 students selected?

A $\frac{1}{45}$  
B $\frac{2}{45}$  
C $\frac{1}{5}$  
D $\frac{2}{5}$

$(3y - 1)^4 =$

A $81y^4 - 108y^3 + 54y^2 - 12y + 1$  
B $81y^4 + 108y^3 - 54y^2 - 12y + 1$  
C $81y^4 - 54y^3 - 108y^2 - 12y + 1$  
D $81y^4 + 54y^3 - 108y^2 - 12y + 1$

How many terms does the binomial expansion of $(x^2 + 2y^3)^{20}$ contain?

A 20  
B 21  
C 40  
D 60
83 What are the first 4 terms in the expansion of 
\((1 + 2x)^6\)?

A \(1 + 12x + 30x^2 + 40x^3\)
B \(1 + 12x + 24x^2 + 48x^3\)
C \(1 + 12x + 30x^2 + 120x^3\)
D \(1 + 12x + 60x^2 + 160x^3\)

84 What is \((x + y)^5\) in expanded form?

A \(x^4 + 4x^2y^2 + 6xy^4 + 4y^4\)
B \(x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4\)
C \(x^5 + 5x^4y + 10x^3y^2 + 5xy^4 + y^5\)
D \(x^5 + 5x^4y + 10x^3y^2 + 10x^2y^3 + 5xy^4 + y^5\)

85 What is the sum of the infinite geometric series

\[\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \ldots\]?

A \(1\)
B \(1.5\)
C \(2\)
D \(2.5\)

86 What is the \(n\)th term in the arithmetic series below?

\(3 + 7 + 11 + 15 + 19 \ldots\)

A \(4n\)
B \(3 + 4n\)
C \(2n + 1\)
D \(4n - 1\)

87 Which expression represents \(f(g(x))\) if \(f(x) = x^2 - 1\) and \(g(x) = x + 3\)?

A \(x^3 + 3x^2 - x - 3\)
B \(x^2 + 6x + 8\)
C \(x^2 + x + 2\)
D \(x^2 + 8\)

88 Given that \(f(x) = 3x^2 - 4\) and \(g(x) = 2x - 6\), what is \(g(f(2))\)?

A \(-2\)
B \(6\)
C \(8\)
D \(10\)
89 If \( f(x) = x^2 + 2x + 1 \) and \( g(x) = 3(x + 1)^2 \), which is an equivalent form of \( f(x) + g(x) \)?

A \( x^2 + 4x + 2 \)
B \( 4x^2 + 2x + 4 \)
C \( 4x^2 + 8x + 4 \)
D \( 10x^2 + 20x + 10 \)

90 A math teacher is randomly distributing 15 rulers with centimeter labels and 10 rulers without centimeter labels. What is the probability that the first ruler she hands out will have centimeter labels and the second ruler will not have labels?

A \( \frac{1}{24} \)
B \( \frac{1}{4} \)
C \( \frac{2}{5} \)
D \( \frac{23}{25} \)

92 One bag contains 2 green marbles and 4 white marbles, and a second bag contains 3 green marbles and 1 white marble. If Trent randomly draws one marble from each bag, what is the probability that they are both green?

A \( \frac{1}{4} \)
B \( \frac{2}{5} \)
C \( \frac{1}{2} \)
D \( \frac{5}{6} \)

93 A box contains 7 large red marbles, 5 large yellow marbles, 3 small red marbles, and 5 small yellow marbles. If a marble is drawn at random, what is the probability that it is yellow, given that it is one of the large marbles?

A \( \frac{5}{12} \)
B \( \frac{7}{20} \)
C \( \frac{5}{8} \)
D \( \frac{1}{5} \)
The probabilities that Jamie will try out for various sports and team positions are shown in the chart below.

Jamie

- Try out for basketball team
  - Try out for guard 80%
  - Try out for forward 20%

- Try out for baseball team
  - Try out for catcher 70%
  - Try out for pitcher 30%

Jamie will definitely try out for either basketball or baseball, but not both. The probability that Jamie will try out for baseball and try out for catcher is 42%. What is the probability that Jamie will try out for basketball?

A 40%
B 60%
C 80%
D 90%
95 A small-business owner must hire seasonal workers as the need arises. The following list shows the number of employees hired monthly for a 5-month period.

4, 13, 5, 6, 9

If the mean of these data is approximately 7, what is the population standard deviation for these data? (Round the answer to the nearest tenth.)

A 3.3  
B 7.4  
C 10.8  
D 13.5  

96 James found the mean and standard deviation of the set of numbers given above. If he adds 5 to each number, which of the following will result?

A The mean will be multiplied by 5.  
B The standard deviation will increase by 5.  
C The mean will not change.  
D The standard deviation will not change.