Introduction - Algebra II

The following released test questions are taken from the Algebra II Standards Test. This test is one of the California Standards Tests administered as part of the Standardized Testing and Reporting (STAR) Program under policies set by the State Board of Education.

All questions on the California Standards Tests are evaluated by committees of content experts, including teachers and administrators, to ensure their appropriateness for measuring the California academic content standards in Algebra II. In addition to content, all items are reviewed and approved to ensure their adherence to the principles of fairness and to ensure no bias exists with respect to characteristics such as gender, ethnicity, and language.

This document contains released test questions from the California Standards Test forms in 2003, 2004, 2005, 2006, 2007, and 2008. First on the pages that follow are lists of the standards assessed on the Algebra II Test. Next are released test questions. Following the questions is a table that gives the correct answer for each question, the content standard that each question is measuring, and the year each question last appeared on the test.

The following table lists each reporting cluster, the number of items that appear on the exam, and the number of released test questions that appear in this document. Some of the released test questions for Algebra II are the same test questions found in different combinations on the Integrated Mathematics 2 and 3 California Standards Tests and the Summative High School Mathematics California Standards Test.

<table>
<thead>
<tr>
<th>REPORTING CLUSTER</th>
<th>NUMBER OF QUESTIONS ON EXAM</th>
<th>NUMBER OF RELEASED TEST QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polynomials and Rational Expressions</td>
<td>19</td>
<td>28</td>
</tr>
<tr>
<td>Quadratics, Conics, and Complex Numbers</td>
<td>17</td>
<td>24</td>
</tr>
<tr>
<td>Exponents and Logarithms</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>Series, Combinatorics, and Probability and Statistics</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>TOTAL</td>
<td>65</td>
<td>96</td>
</tr>
</tbody>
</table>

In selecting test questions for release, three criteria are used: (1) the questions adequately cover a selection of the academic content standards assessed on the Algebra II Test; (2) the questions demonstrate a range of difficulty; and (3) the questions present a variety of ways standards can be assessed. These released test questions do not reflect all of the ways the standards may be assessed. Released test questions will not appear on future tests.

For more information about the California Standards Tests, visit the California Department of Education’s Web site at http://www.cde.ca.gov/ta/tg/sr/resources.asp.
THE POLYNOMIALS AND RATIONAL EXPRESSIONS REPORTING CLUSTER

The following five California content standards are included in the Polynomials and Rational Expressions reporting cluster and are represented in this booklet by 28 test questions. These questions represent only some ways in which these standards may be assessed on the Algebra II California Mathematics Standards Test.

**CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER**

<table>
<thead>
<tr>
<th>Algebra II</th>
<th>1.0*</th>
<th>Students solve equations and inequalities involving absolute value.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.0*</td>
<td>Students solve systems of linear equations and inequalities (in two or three variables) by substitution, with graphs, or with matrices.</td>
</tr>
<tr>
<td></td>
<td>3.0*</td>
<td>Students are adept at operations on polynomials, including long division.</td>
</tr>
<tr>
<td></td>
<td>4.0*</td>
<td>Students factor polynomials representing the difference of squares, perfect square trinomials, and the sum and difference of two cubes.</td>
</tr>
<tr>
<td></td>
<td>7.0*</td>
<td>Students add, subtract, multiply, divide, reduce, and evaluate rational expressions with monomial and polynomial denominators and simplify complicated rational expressions, including those with negative exponents in the denominator.</td>
</tr>
</tbody>
</table>

* Denotes key standards
THE QUADRATICS, CONICS, AND COMPLEX NUMBERS REPORTING CLUSTER

The following seven California content standards are included in the Quadratics, Conics, and Complex Numbers reporting cluster and are represented in this booklet by 24 test questions. These questions represent only some ways in which these standards may be assessed on the Algebra II California Mathematics Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

<table>
<thead>
<tr>
<th>Algebra II</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0*</td>
</tr>
<tr>
<td>6.0*</td>
</tr>
<tr>
<td>8.0*</td>
</tr>
<tr>
<td>9.0*</td>
</tr>
<tr>
<td>10.0*</td>
</tr>
<tr>
<td>16.0</td>
</tr>
<tr>
<td>17.0</td>
</tr>
</tbody>
</table>

* Denotes key standards
**THE EXPONENTS AND LOGARITHMS REPORTING CLUSTER**

The following six California content standards are included in the Exponents and Logarithms reporting cluster and are represented in this booklet by 24 test questions. These questions represent only some ways in which these standards may be assessed on the Algebra II California Mathematics Standards Test.

**CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER**

<table>
<thead>
<tr>
<th>Algebra II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard Set 11.0</strong></td>
</tr>
<tr>
<td>11.1*</td>
</tr>
<tr>
<td>11.2*</td>
</tr>
<tr>
<td>12.0*</td>
</tr>
<tr>
<td>13.0</td>
</tr>
<tr>
<td>14.0</td>
</tr>
<tr>
<td>15.0*</td>
</tr>
</tbody>
</table>

* Denotes key standards
THE SERIES, COMBINATORICS, AND PROBABILITY AND STATISTICS REPORTING CLUSTER

The following 10 California content standards are included in the Series, Combinatorics, and Probability and Statistics reporting cluster and are represented in this booklet by 20 test questions. These questions represent only some ways in which these standards may be assessed on the Algebra II California Mathematics Standards Test.

### CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

**Algebra II**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.0*</td>
<td>Students use fundamental counting principles to compute combinations and permutations.</td>
</tr>
<tr>
<td>19.0*</td>
<td>Students use combinations and permutations to compute probabilities.</td>
</tr>
<tr>
<td>20.0*</td>
<td>Students know the binomial theorem and use it to expand binomial expressions that are raised to positive integer powers.</td>
</tr>
<tr>
<td>21.0</td>
<td>Students apply the method of mathematical induction to prove general statements about the positive integers.</td>
</tr>
<tr>
<td>22.0</td>
<td>Students find the general term and the sums of arithmetic series and of both finite and infinite geometric series.</td>
</tr>
<tr>
<td>24.0</td>
<td>Students solve problems involving functional concepts, such as composition, defining the inverse function and performing arithmetic operations on functions.</td>
</tr>
<tr>
<td>25.0</td>
<td>Students use properties from number systems to justify steps in combining and simplifying functions.</td>
</tr>
</tbody>
</table>

**Probability and Statistics**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS1.0</td>
<td>Students know the definition of the notion of independent events and can use the rules for addition, multiplication, and complementation to solve for probabilities of particular events in finite sample spaces.</td>
</tr>
<tr>
<td>PS2.0</td>
<td>Students know the definition of conditional probability and use it to solve for probabilities in finite sample spaces.</td>
</tr>
<tr>
<td>PS7.0</td>
<td>Students compute the variance and the standard deviation of a distribution of data.</td>
</tr>
</tbody>
</table>

* Denotes key standards
1. What is the complete solution to the equation $|3 - 6x| = 15$?
   - A $x = 2; x = 3$
   - B $x = -2; x = 3$
   - C $x = 2; x = -3$
   - D $x = -2; x = -3$

2. What are the possible values of $x$ in $|12 - 4x| = 2$?
   - A $x = -2.50$ or $x = -3.50$
   - B $-3.50 < x < -2.50$
   - C $3.5 > x > 2.5$
   - D $x = 2.50$ or $x = 3.50$

3. For a wedding, Shereda bought several dozen roses and several dozen carnations. The roses cost $15$ per dozen, and the carnations cost $8$ per dozen. Shereda bought a total of 17 dozen flowers and paid a total of $192$. How many roses did she buy?
   - A 6 dozen
   - B 7 dozen
   - C 8 dozen
   - D 9 dozen

4. What is the solution to the system of equations shown below?
   \[
   \begin{align*}
   2x - y + 3z &= 8 \\
   x - 6y - z &= 0 \\
   -6x + 3y - 9z &= 24
   \end{align*}
   \]
   - A $(0,4,4)$
   - B $\left(1,4,\frac{10}{3}\right)$
   - C no solution
   - D infinitely many solutions

5. A restaurant manager bought 20 packages of bagels. Some packages contained 6 bagels each, and the rest contained 12 bagels each. There were 168 bagels in all. How many packages of 12 bagels did the manager buy?
   - A 6
   - B 8
   - C 9
   - D 12
6 What system of inequalities best represents the graph shown below?

A $y > -2$ and $y > x + 1$
B $y > -2$ and $y < x + 1$
C $y < -2$ and $y > x + 1$
D $y < -2$ and $y < x + 1$

7 Which point lies in the solution set for the system $\begin{cases} 2y - x \geq -6 \\ 2y - 3x < -6 \end{cases}$?

A $(-4, -1)$
B $(3, 1)$
C $(0, -3)$
D $(4, 3)$
9. What is the solution to the following system of equations?

\[
\begin{aligned}
2x - 3y &= 4 \\
4x + y &= -6
\end{aligned}
\]

A. (5, -2)  
B. (-2, 5)  
C. (-1, -2)  
D. (-2, -1)

12. \((-2x^2 + 6x + 1) - 2(4x^2 - 3x + 1) =\)

A. \(6x^2 - 1\)  
B. \(-10x^2 - 1\)  
C. \(6x^2 + 12x - 1\)  
D. \(-10x^2 + 12x - 1\)

13. Which expression is equivalent to \((6y^2 - 2)(6y + 2)\)?

A. \(36y^2 - 4\)  
B. \(36y^3 - 4\)  
C. \(36y^2 + 12y^2 + 12y - 4\)  
D. \(36y^3 + 12y^2 - 12y - 4\)

14. What is the volume of the figure below?
15. What is \((5x^3 - 2x)(3x^2 + x - 8)\)?
   
   A. \(5x^3 + 3x^2 - x - 8\)
   B. \(15x^5 - x^4 - 42x^3 + 16x\)
   C. \(15x^5 + 5x^4 - 46x^3 - 2x^2 + 16x\)
   D. \(15x^6 - 35x^3 - 6x^2 + 14x\)

16. \(8a^3 + c^3 = \)
   
   A. \((2a + c)(2a + c)(2a + c)\)
   B. \((2a - c)(4a^2 + 2ac + c^2)\)
   C. \((2a - c)(4a^2 + 4ac + c^2)\)
   D. \((2a + c)(4a^2 - 2ac + c^2)\)

17. The total area of a rectangle is \(4x^4 - 9y^2\). Which factors could represent the length times width?
   
   A. \((2x^2 - 3y)(2x^2 + 3y)\)
   B. \((2x^2 + 3y)(2x^2 + 3y)\)
   C. \((2x - 3y)(2x - 3y)\)
   D. \((2x + 3y)(2x - 3y)\)

18. Which product of factors is equivalent to \((x + 1)^2 - y^2\)?
   
   A. \((x + 1 + y)^2\)
   B. \((x + 1 - y)^2\)
   C. \((x - 1 + y)(x - 1 - y)\)
   D. \((x + 1 + y)(x + 1 - y)\)

19. Which expression shows the complete factorization of \(12x^2 - 147\)?
   
   A. \((3x - 7)(4x + 2)\)
   B. \((4x - 21)(3x + 7)\)
   C. \(12(x - 7)(x + 7)\)
   D. \(3(2x - 7)(2x + 7)\)

20. \(25x^2 - 40xy + 16y^2 = \)
   
   A. \((5x - 4y)^2\)
   B. \((5x + 10 - 4y)^3\)
   C. \(5(5x - 4y)^2\)
   D. \(5(4xy)^2\)

21. \(\frac{x + 3}{x + 5} + \frac{6}{x^2 + 3x - 10} = \)
   
   A. \(\frac{x^2 + x}{x^2 + 3x - 10}\)
   B. \(\frac{7x - 9}{x^2 + 3x - 10}\)
   C. \(\frac{x^2 + x + 12}{x^2 + 3x - 10}\)
   D. \(\frac{x^2 + x + 1}{x^2 + 3x - 10}\)
22 Which is a simplified form of \( \frac{3a^2b^3c^{-2}}{(a^{-1}b^2c)^3} \)?

A \( \frac{3a^5}{b^3c^5} \)
B \( \frac{3ab}{c^5} \)
C \( \frac{3}{b^2c^5} \)
D \( \frac{3}{ab^3c^5} \)

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25 \( \frac{x^2 + 4x}{x + 3} \cdot \frac{x^2 - 9}{x^2 + x - 12} = \)

A \( 1 \)
B \( x \)
C \( x + 4 \)
D \( \frac{x + 3}{x - 3} \)

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23 What is \( \frac{20x^{-4}}{27y^2} \div \frac{8x^{-3}}{15y^{-5}} \)?

A \( \frac{32y^3}{81x} \)
B \( \frac{32}{81xy^7} \)
C \( \frac{25y^3}{18x} \)
D \( \frac{25}{18xy^7} \)

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26 What is the simplest form of \( \frac{5x^3y + 20x^2y^2 + 20xy^3}{5xy} \)?

A \( (x + 2)^2 \)
B \( (x + 2y)^2 \)
C \( x^2 + y^2 \)
D \( x^2 + 4y^2 \)

---

27 \( \frac{2x^2 - 10x}{x^2 + 8x + 16} \cdot \frac{4x + 16}{x^2 - 25} = \)

A \( \frac{8x}{(x + 4)(x - 5)} \)
B \( \frac{2x + 4}{(x + 4)(x + 5)} \)
C \( \frac{8x}{(x + 4)(x + 5)} \)
D \( \frac{2x + 4}{x^2 + 20} \)
28 \[ \frac{4(x + y)}{5x^2y^3} \div \frac{-2x - 2y}{10} = \]

A. \( \frac{4}{x^2y^3} \)
B. \( \frac{4}{x^2y^3} \)
C. \( \frac{-4(x + y)}{x^2y^3(x - y)} \)
D. \( \frac{4(x + y)^2}{5x^2y^3} \)

30 If \( i = \sqrt{-1} \), what is the value of \( i^4 \)?

A. \( i \)
B. \( -i \)
C. 1
D. \( -1 \)

31 Which of the following complex numbers is represented by the point on the graph below?

A. \( 4 + 3i \)
B. \( 4 - 3i \)
C. \( 3 - 4i \)
D. \( 3 + 4i \)
### Algebra II

#### Released Test Questions

**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 $\frac{4 - i}{4}$
- C $\frac{3 - i}{5}$
- 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 $9 - 9i$
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 $\frac{1}{x^2} + \frac{3}{x} = ?$
   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 \( 3 - 2i \)

44 Which of the following *most* accurately describes the translation of the graph \( y = (x + 3)^2 - 2 \) to the graph of \( y = (x - 2)^2 + 2 \)?

A up 4 and 5 to the right
B down 2 and 2 to the right
C down 2 and 3 to the left
D up 4 and 2 to the left

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 \( \frac{1}{4} \)
47 Which is the graph of \( y = -2(x - 1)^2 + 1 \)?
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. \(\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1\)

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. \(x = \frac{\log_{10} 17}{\log_{10} 5}\)

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

A. \(x = -\sqrt{\frac{1}{10}}\)
B. \(x = \sqrt{\frac{1}{10}}\)
C. \(x = \frac{1}{100}\)
D. \(x = 100\)

55. Which equation is equivalent to \(\log_3 \frac{1}{9} = x\)?

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

56. If \(\log_{10} y = 2\), 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 \(\frac{4}{64}\)?

Step 1: \(\log_4 \frac{4}{64} = \log_4 4 - \log_4 64\)
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**  
\[x^3 x^{-7} = \frac{x^3}{x^{-7}} = x^{10}, \quad x \neq 0\]

**Shanan’s work**  
\[x^3 x^{-7} = \frac{x^3}{x^7} = \frac{1}{x^4}, \quad x \neq 0\]

**Michael’s work**  
\[x^3 x^{-7} = \frac{x^3}{x^{-7}} = x^{-4}, \quad x \neq 0\]

**Brenda’s work**  
\[x^3 x^{-7} = \frac{x^3}{x^7} = x^4, \quad x \neq 0\]

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:**  
\[(x^2)^3 - (x^5)^{-1} = x^6 - x^{-5}\]

**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

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This is a sample of California Standards Test questions. This is NOT an operational test form. Test scores cannot be projected based on performance on released test questions. Copyright © 2009 California Department of Education.
61  A certain radioactive element decays over time according to the equation \( y = A \left(\frac{1}{2}\right)^t \), 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>
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<tr>
<th>Day</th>
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<td>1</td>
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</tr>
<tr>
<td>2</td>
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</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 \( f(x) = 3^{-x} - 2 \)?

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<th>( f(x) )</th>
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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. $6 - 4 = 2$

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 \( x = 4 \).

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.

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, 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
78 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

79 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

80 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 \( \frac{2}{5} \)

81 \((3y-1)^4 = \)

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 \(81y^4 + 54y^3 - 108y^2 - 12y + 1\)

82 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 \(x^4 + 4x^2y^2 + 6xy + 4xy^2 + y^4\)
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
If \( f(x) = x^2 + 2x + 1 \) and \( g(x) = 3(x + 1)^2 \), which is an equivalent form of \( f(x) + g(x) \)?

\[
\begin{align*}
A & \quad x^2 + 4x + 2 \\
B & \quad 4x^2 + 2x + 4 \\
C & \quad 4x^2 + 8x + 4 \\
D & \quad 10x^2 + 20x + 10
\end{align*}
\]

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?

\[
\begin{align*}
A & \quad \frac{1}{24} \\
B & \quad \frac{1}{4} \\
C & \quad \frac{2}{5} \\
D & \quad \frac{23}{25}
\end{align*}
\]

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?

\[
\begin{align*}
A & \quad \frac{1}{4} \\
B & \quad \frac{2}{5} \\
C & \quad \frac{1}{2} \\
D & \quad \frac{5}{6}
\end{align*}
\]

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?

\[
\begin{align*}
A & \quad \frac{5}{12} \\
B & \quad \frac{7}{20} \\
C & \quad \frac{5}{8} \\
D & \quad \frac{1}{5}
\end{align*}
\]
The probabilities that Jamie will try out for various sports and team positions are shown in the chart below.

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%
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

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.
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