

Math III Skills Checklist

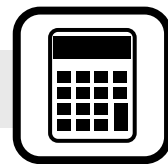
	Can you...		Can you...
1. Functions	<p>DOMAIN AND RANGE Identify the domain and range of a function based on its graph?</p> <p>TRANSFORMATIONS Look at an equation and identify the parent function and all transformations?</p> <p>MODELING Take a table of data, enter it into your calculator and create a linear or quadratic regression equation? Use your model to predict dependent and independent variable values?</p>	2. Quadratics	<p>FACTORING Factor out the GCF from a quadratic expression?</p> <p>AC METHOD Use the AC method to factor a quadratic expression or equation?</p> <p>Factor a quadratic equation when a is not equal to 1 using the Swing method or grouping method?</p> <p>SOLVE BY GRAPHING Find the zeroes of a quadratic function by using your calculator?</p> <p>QUADRATIC FORMULA Sing the quadratic formula from memory? Use the quadratic formula to solve a quadratic equation?</p> <p>VERTEX FORM Complete the square or use the shortcut formula to put a quadratic in Vertex form? Identify the vertex of quadratic function from its equation?</p> <p>EXTRANEIOUS SOLUTIONS Determine if a solution to a radical to a radical equation is extraneous?</p> <p>COMPLEX NUMBERS Add, subtract, multiply, and divide complex numbers? Solve quadratic equations with complex roots?</p> <p>Identify the real and imaginary parts of a complex number?</p> <p>FOCUS AND DIRECTRIX Find the focus and directrix from the vertex form of a quadratic equation?</p> <p>Given a combination of vertex, focus and/or directrix, create the equation of the parabola?</p>
	<p>3. Polynomials</p> <p>DIVIIDING POLYNOMIAL FUNCTIONS? Use both Long Division and Synthetic Division when dividing a polynomial by another?</p> <p>SPECIAL CASES Recognize the pattern for a difference of squares? Factor a sum or difference of cubes?</p> <p>REMAINDER THEOREM Use the remainder theorem to determine if a given factor is a root?</p> <p>FINDING ALL ROOTS Find both the real and complex (imaginary) roots of a polynomial?</p> <p>BINOMIAL EXPANSION and PASCAL'S TRIANGLE Use the Binomial Theorem and Pascal's triangle to expand polynomials of the form $(a + b)^n$</p> <p>Determine specific terms in a polynomial expansion?</p>		

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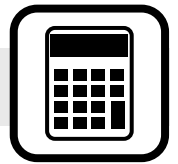
	Can you...		Can you...
4. Rational Functions	<p>SIMPLIFYING Reduce fractions to their simplest form and identify restrictions on their domain?</p> <p>ADDING/SUBTRACTING Find common denominators then combine the rational functions into a single fraction?</p> <p>MULTIPLYING/DIVIDING Multiply two fractions by factoring and canceling common factors. Identify restrictions on the domain?</p> <p>Divide two fractions by turning it into a multiplication problem? (KCF)</p> <p>GRAPHING Identify the vertical and horizontal asymptotes for a rational function?</p> <p>Identify holes?</p> <p>Identify the zeroes and y intercepts?</p> <p>SOLVING Solve rational equations and check for extraneous solutions?</p> <p>COMPLEX FRACTIONS Simplify expressions with fractions in the numerator and/or denominator?</p> <p>WORK PROBLEMS Solve word problems that relate work and time?</p>	5. Logarithms and Exponential Functions	<p>LOGARITHMIC AND EXPONENTIAL FORM. Rewrite logarithmic expressions in exponential form and vice versa?</p> <p>EXPANDING AND CONTRACTING LOGARITHMIC EXPRESSIONS Use the properties of logarithms to expand a single logarithmic expression into multiple log statements?</p> <p>Use the properties of logarithms to rewrite several log expressions into a single log statement?</p> <p>SOLVING EQUATIONS Solve exponential and logarithmic equations by rewriting in the "other" form?</p> <p>EXPONENTIAL GROWTH AND DECAY MODELS Predict depreciation and appreciation values using the growth and decay equations?</p> <p>COMPOUNDING INTEREST (PERIODIC AND CONTINUOUS) Do you know the two different formulas for compounding interest?</p>

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6. Geometry	<p>ANGLE MEASURES Find congruent and supplementary angles on a transversal cutting through parallel lines?</p> <p>TRIANGLE, CONGRUENCY AND SIMILARITY Determine when two triangles are congruent using the triangle congruency theorems?</p> <p>Determine when two triangles are similar using the properties of similarity?</p> <p>CIRCLES – ANGLES Determine angle measure for central angles, inscribed angles and angles outside the circle?</p> <p>CIRCLES – CHORDS, SECANTS, TANGENTS Determine segment lengths using the theorems related to chords, secants and tangents?</p> <p>TWO COLUMN PROOFS Write a two column proof using CPCTC and triangle similarity or congruence theorems?</p>	7. Trigonometry	<p>UNIT CIRCLE PROPERTIES Construct a unit circle from memory (Angle measures in degrees, radians and coordinates of each point in the circle)?</p> <p>Find sine, cosine and tangent from the coordinates on the unit circle?</p> <p>RADIAN AND DEGREE MEASURE Convert between radian and degree angle measures?</p> <p>TRIG IDENTITIES Prove identities by rewriting expressions in terms of sine and cosine?</p> <p>Derive the three Pythagorean Identities?</p> <p>TRIG EQUATIONS AND THEIR GRAPHS Identify the sine, cosine and tangent functions from their graph?</p> <p>Identify amplitude, period and transformations on a sine and cosine graph?</p> <p>Identify transformations represented in a trigonometric equation?</p>
8. Statistics	<p>MEAN/MEDIAN/MODE/STANDARD DEVIATION Calculate these statistical measures using your calculator?</p> <p>NORMAL CURVE Use the area under Normal Curve to determine probability and percentages?</p> <p>Describe how standard deviation relates to the mean of a dataset?</p> <p>SAMPLES AND SURVEYS Identify the different types of samples and surveys?</p> <p>Determine how bias might be introduced into a survey?</p>	9. Sequences and Series	<p>ARITHMETIC Find a specific term in an arithmetic sequence?</p> <p>Find the sum of an arithmetic series?</p> <p>GEOMETRIC Find a specific term in a Geometric sequence?</p> <p>Find the sum of a Geometric series?</p>



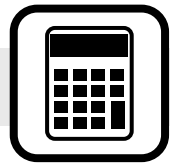
- 1 Which expression is equivalent to $(x + 3)^3 - 9x(x + 3)$?
- A $x^3 + 27$
- B $x^3 - 27$
- C $x^3 - 9x^2 - 27x + 27$
- D $x^3 - 9x^2 + 27x + 27$
- 2 Suppose $p(x) = x^3 - 2x^2 + 13x + k$. The remainder of the division of $p(x)$ by $(x + 1)$ is -8 . What is the remainder of the division of $p(x)$ by $(x - 1)$?
- A -8
- B 8
- C 16
- D 20
- 3 What is the **approximate** solution to the equation $3^{x-1} = 4^{2x+5}$?
- A 3.875
- B 1.262
- C -2.354
- D -4.797



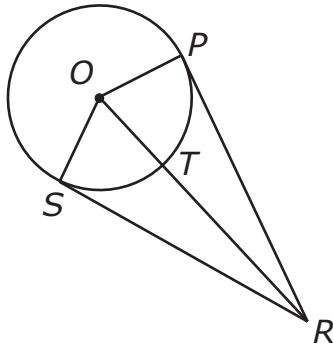
- 4 Samantha invested \$10,000 in each of two different financial plans in 2013. The predicted value of each plan is modeled below.
- Plan M: a rate of 7.5%, compounded continuously.
 - Plan N: The value is determined by the function $y = 5x^3 - 50x^2 + 4x + 10,000$, where x is the number of years after 2013.

Plan N has a greater predicted value than Plan M during which years?

- A from 2014 to 2041
- B from 2028 to 2055
- C from 2042 to 2073
- D Plan N never has a greater value than Plan M.
- 5 Which is an equation of a parabola that has a directrix of $y = -5$ and a focus at $(2, -1)$?
- A $y = \frac{1}{2}(x + 2)^2 + 2$
- B $y = \frac{1}{8}(x + 2)^2 + 3$
- C $y = \frac{1}{8}(x - 2)^2 - 3$
- D $y = \frac{1}{2}(x - 2)^2 - 2$



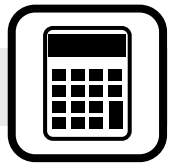
- 6 In the figure below, \overline{PR} and \overline{SR} are tangent to circle O .



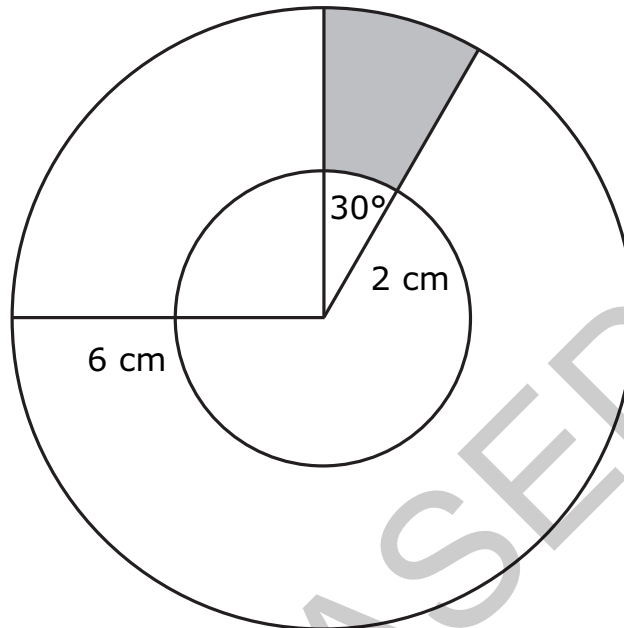
If $OT = 11$ cm and $PR = 60$ cm, what is the length of \overline{OR} ?

- A 61 cm
- B 59 cm
- C 50 cm
- D 48 cm

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- 7 In the figure below, the larger circle has a radius of 6 cm, and the smaller circle has a radius of 2 cm.



What is the **approximate** area of the shaded region?

- A 2.1 cm²
- B 3.4 cm²
- C 4.2 cm²
- D 8.4 cm²



8 Which choice shows the solutions to the equation $8x^2 + 3x = -7$?

A $\frac{-3 \pm i\sqrt{215}}{16}$

B $\frac{3 \pm i\sqrt{215}}{16}$

C $\frac{-3 \pm \sqrt{233}}{16}$

D $\frac{3 \pm \sqrt{233}}{16}$

9 A system of equations is shown below.

$$y = |x - 3|$$

$$y = \frac{1}{2}x$$

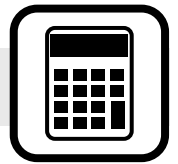
What is the distance between the points of intersection of the system?

A $\sqrt{6}$

B $\sqrt{20}$

C $\sqrt{48}$

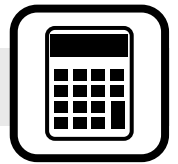
D $\sqrt{80}$



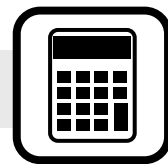
- 10 Fred drives an average of 15,000 miles per year, and his car gets 20 miles per gallon of gasoline.
- The average cost of gasoline is \$3.25 per gallon.
 - He buys a new car.
 - In his new car, Fred continues to average 15,000 miles per year, and the average cost of gasoline remains the same.

Approximately how many more miles per gallon does the new car get if Fred has a savings of \$650 per year on gasoline?

- A 5.8 mpg
- B 7.3 mpg
- C 8.8 mpg
- D 10.3 mpg
- 11 A student wants to determine the most liked professor at her college. Which type of study would be the **most** practical to obtain this information?
- A a simulation
- B an experiment
- C a survey
- D an observation



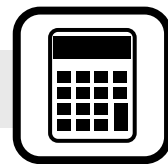
- 12 A principal wants to survey 150 students to determine which electives to offer during the next school year. There are 1,800 students in the school. Which procedure could the principal use to select a sample using a systematic random sample?
- A Obtain a list of all students. Start with the eighth student, and select every twelfth student until 150 students have been selected.
 - B Select the first 150 students who enter the school.
 - C Choose the fifth student to come into the cafeteria, and then select every third student who comes into the cafeteria until 150 students have been selected.
 - D Place students' names on slips of paper and select 150 slips.
- 13 What value of h is needed to complete the square for the equation $x^2 + 10x - 8 = (x - h)^2 - 33$?
- A -25
 - B -5
 - C 5
 - D 25



- 14 A shipping company is designing boxes to meet specific requirements.
- Each box must be a completely closed rectangular prism with no overlapping material.
 - The boxes must hold 24 cans in two layers of 12 cans each.
 - The cans are 3 inches in diameter and 5 inches in height.

What is the smallest amount of cardboard needed to meet the specifications?

- A 1,080 in.²
- B 840 in.²
- C 636 in.²
- D 540 in.²
- 15 Which expression is equivalent to $\frac{\cos(\theta)}{1 - \sin(\theta)} - \tan(\theta)$?
- A $\sec(\theta)$
- B $\sin(\theta)$
- C $\cos(\theta)$
- D $\csc(\theta)$



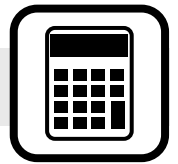
16 William put the tip of his pencil on the outer edge of a graph of the unit circle at the point $(0, -1)$. He moved his pencil tip through an angle of $\frac{4\pi}{3}$ radians in the counterclockwise direction along the edge of the circle. At what angle of the unit circle did William's pencil tip stop?

- A $\frac{\pi}{3}$
- B $\frac{5\pi}{6}$
- C $\frac{7\pi}{6}$
- D $\frac{5\pi}{3}$

17 A town has 685 households. The number of people per household is normally distributed with a mean, μ , of 3.67 and a standard deviation, σ , of 0.34.

Approximately how many households have between 2.99 and 4.01 people?

- A 493 households
- B 520 households
- C 558 households
- D 575 households



18 The graph of the function $f(x) = x^3$ will be shifted down 2 units and to the right 3 units. Which is the function that corresponds to the resulting graph?

A $g(x) = (x + 3)^3 + 2$

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

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

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

19 Which is the inverse of $f(x) = 1.5^x + 4$?

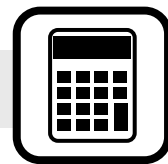
A $f^{-1}(x) = \frac{x - 4}{1.5}$

B $f^{-1}(x) = \frac{\log(x) - 4}{1.5}$

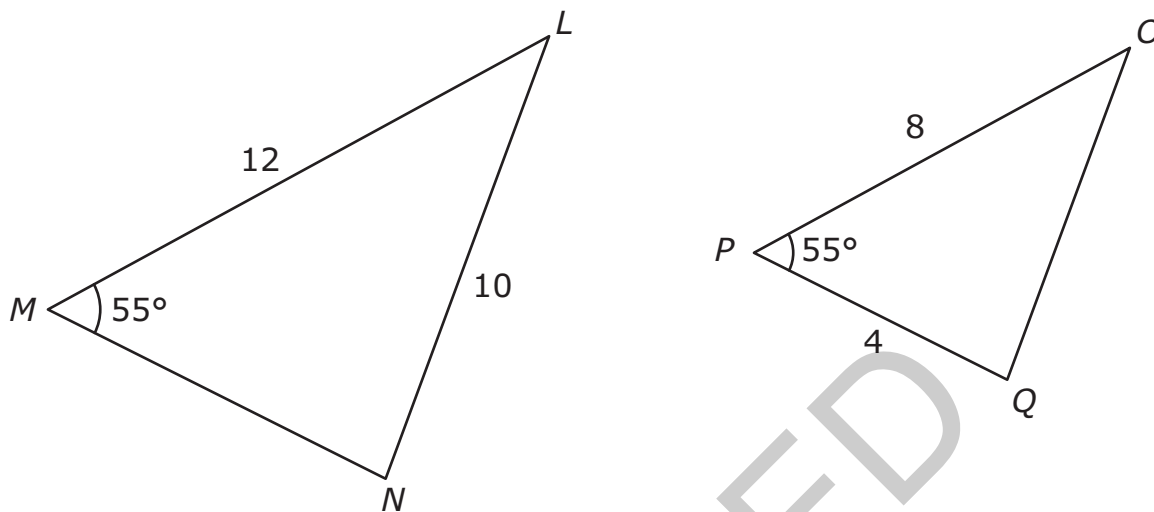
C $f^{-1}(x) = \frac{\log(x - 4)}{\log(1.5)}$

D $f^{-1}(x) = \frac{4 - \log(x)}{\log(1.5)}$

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20 Triangles LMN and OPQ are shown below.



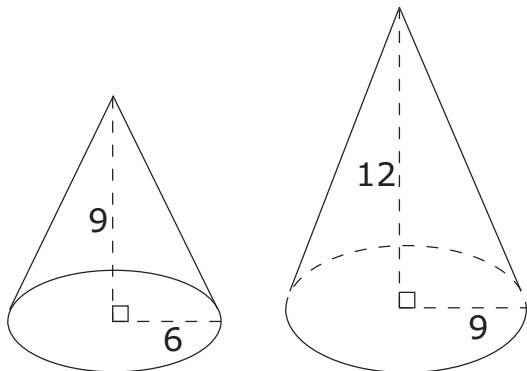
What additional information is sufficient to show that $\triangle LMN$ can be transformed and mapped onto $\triangle OPQ$?

- A $OQ = 6$
- B $MN = 9$
- C $\angle LMN \cong \angle QOP$
- D $\angle NLM \cong \angle QOP$

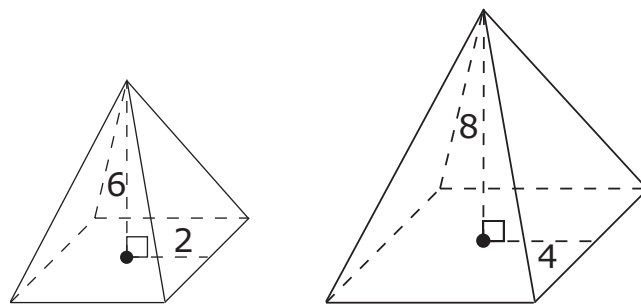


21 Which choice shows a pair of similar figures?

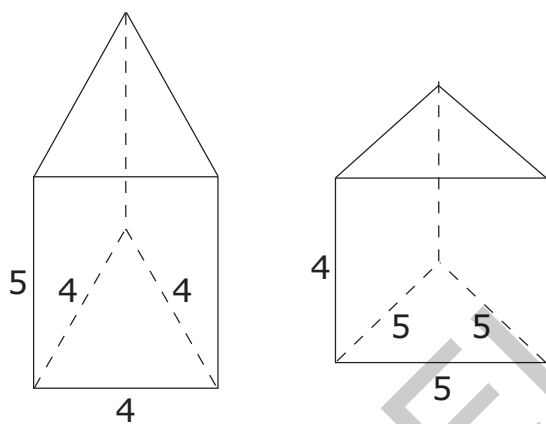
A



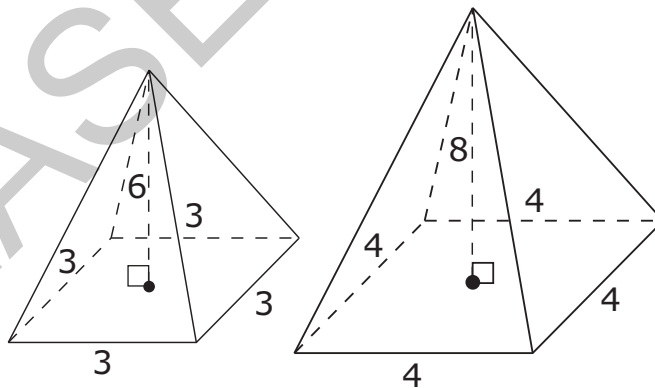
B



C



D

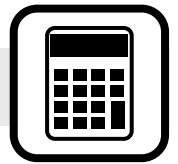


22 What is the **approximate** value of the sum:

$$8 - \frac{8}{7} + \frac{8}{49} - \dots + 8 \cdot \left(-\frac{1}{7}\right)^{2,500} ?$$

(Note: The sum of a series can be calculated using the formula $S_n = \frac{a_1(1 - r^n)}{1 - r}$, where $r \neq 1$.)

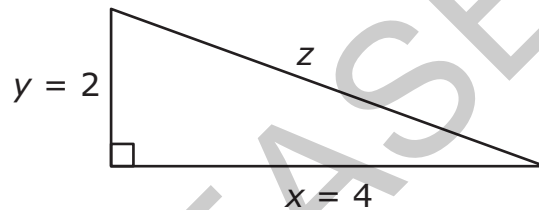
- A 1
- B 7
- C 8
- D 9



- 23 The volume of a rectangular prism is represented by the expression $(x^3 - 2x^2 - 20x - 24)$. If the length is $(x - 6)$ and the height and width are equal, what is the width of the prism?

- A $x + 2$
- B $x - 2$
- C $x + 4$
- D $x - 4$

- 24 A right triangle is shown below.



Which expression would result in an irrational number?

- A $x^2 + y^2$
- B $\frac{1}{2}xy$
- C $x + y + z$
- D $x^2 - z^2$

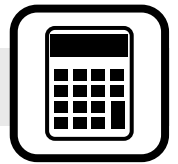


25 Which expression is equivalent to $(4 - 3i)^2 + (6 + i)^2$?

- A 30
- B $42 - 12i$
- C 50
- D $62 - 12i$

This is the end of the multiple-choice portion of the test.

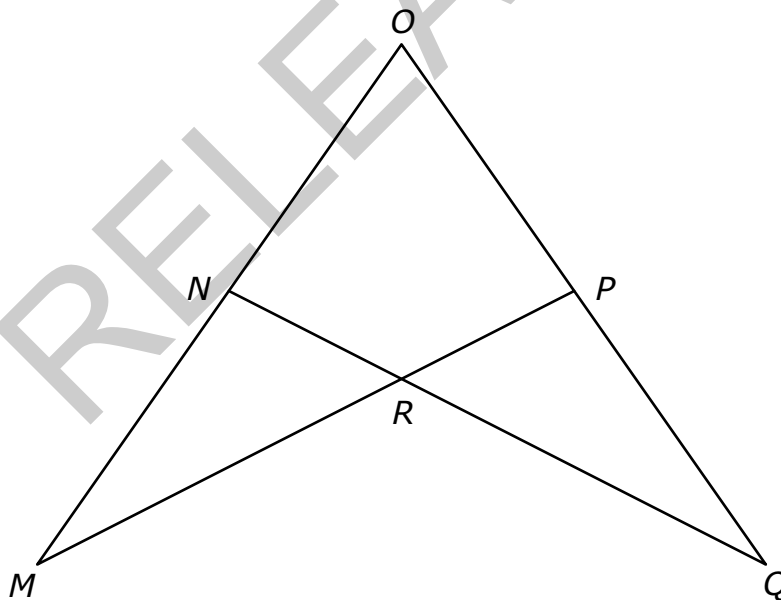
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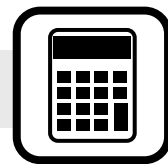
The questions you read next will require you to answer in writing.

1. Write your answers on separate paper.
2. Be sure to write your name on each page.

- 1 The function f is defined as $f(x) = 6x^4 + x^3 + 4x^2 + x - 2$.
- Using the Remainder Theorem, determine if $\frac{1}{2}$ is a root of $f(x)$. Explain.
 - If i is also a root, what are the other two roots?
- 2 In the diagram of $\triangle OMP$ and $\triangle OQN$, $\angle M \cong \angle Q$ and $\overline{MO} \cong \overline{QO}$.



Based on the diagram, write a proof showing $\overline{MN} \cong \overline{QP}$.

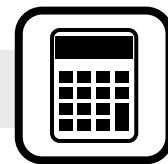


3 Given the function:

$$g(x) = \frac{(x - 2)(3x + 2)}{(x + 4)(x - 2)(x - 6)}$$

- What are the equations of the asymptotes of the function?
- Determine if there are any points of discontinuity. Explain why or why not.
- Describe the end behavior as x approaches $-\infty$ and as x approaches $+\infty$.

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- 1 A board is made up of 9 squares. A certain number of pennies is placed in each square, following a geometric sequence. The first square has 1 penny, the second has 2 pennies, the third has 4 pennies, etc. When every square is filled, how many pennies will be used in total?
- A 512
B 511
C 256
D 81
- 2 Let $f(x) = 14x^3 + 28x^2 - 46x$ and $g(x) = 2x + 7$. Which is the solution set to the equation $\frac{1}{12}f(x) = g(x)$?
- A $\{-3, 0, 1\}$
B $\{-3, -1, 2\}$
C $\{-2, 1, 3\}$
D $\{1, 5, 11\}$
- 3 The equation $2x^2 - 5x = -12$ is rewritten in the form of $2(x - p)^2 + q = 0$. What is the value of q ?
- A $\frac{167}{16}$
B $\frac{71}{8}$
C $\frac{25}{8}$
D $\frac{25}{16}$



- 4 A box with an open top will be constructed from a rectangular piece of cardboard.
- The piece of cardboard is 8 inches wide and 12 inches long.
 - The box will be constructed by cutting out equal squares of side x at each corner and then folding up the sides.

What is the entire domain for the function $V(x)$ that gives the volume of the box as a function of x ?

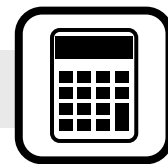
- A $0 < x < 4$
 B $0 < x < 6$
 C $0 < x < 8$
 D $0 < x < 12$

- 5 A function is shown below.

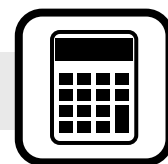
$$f(x) = \begin{cases} -x^2 + 2x & \text{for } x \leq -3 \\ 2\left(\frac{1}{3}\right)^{2x} & \text{for } -3 < x < 4 \\ \frac{2x - 5}{x - 7} & \text{for } x \geq 4 \end{cases}$$

What is the value of the expression $f(-3) + 2f(-1) - f(4)$?

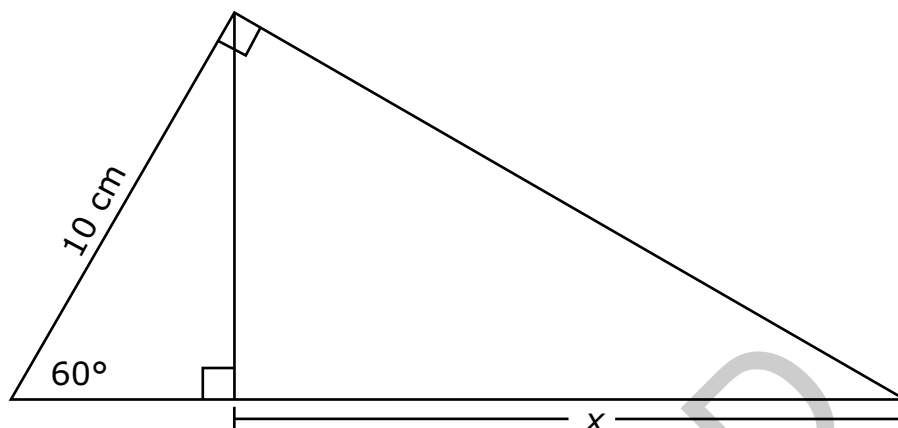
- A $\frac{101}{36}$
 B $\frac{32}{9}$
 C 4
 D 22



- 6 Which function goes to positive ∞ most quickly as x increases?
- A $y = \log(x) + 100$
- B $y = e^{x-9} - 3$
- C $y = x^2 + 5x + 6$
- D $y = 3x^5 + 4x^3 - 11x - 6$
- 7 Which expression is equivalent to $\frac{\sin^4(\theta) - \cos^4(\theta)}{\sin^2(\theta) - \cos^2(\theta)}$, where $\sin^2(\theta) \neq \cos^2(\theta)$?
- A $\sin^2(\theta) - \cos^2(\theta)$
- B $\cos^2(\theta) - \sin^2(\theta)$
- C 2
- D 1
- 8 The diameter of a circle is 8 centimeters. A central angle of the circle intercepts an arc of 12 centimeters. What is the radian measure of the angle?
- A $\frac{3}{2}$
- B 3
- C 4
- D 8π



- 9 What is the value of x in the triangle below?



- A $\frac{5\sqrt{3}}{2}$ cm
- B $5\sqrt{3}$ cm
- C 10 cm
- D 15 cm
- 10 To completely cover a spherical ball, a ball company uses a total area of 36 square inches of material. What is the maximum volume the ball can have?
- (Note: Surface area of a sphere = $4\pi r^2$. Volume of a sphere = $\frac{4}{3}\pi r^3$.)
- A 27π cubic inches
- B $36\sqrt{\pi}$ cubic inches
- C $\frac{36}{\sqrt{\pi}}$ cubic inches
- D $\frac{27}{\pi}$ cubic inches



- 11 A farmer wants to buy between 90 and 100 acres of land.
- He is interested in a rectangular piece of land that is 1,500 yards long and 300 yards wide.
 - The piece of land is being sold as one complete unit for \$87,000.

If the farmer does not want to spend more than \$900 an acre, does the land meet all of his requirements? (1 acre \approx 43,560 ft²)

- A Yes, the amount of land satisfies his needs, and the price is low enough.
- B No, the price is low enough, but there is too much land.
- C No, the price is low enough, but there is not enough land.
- D No, the amount of land satisfies what he needs, but the price is too high.
- 12 A reporter wants to know the percentage of voters in the state who support building a new highway. What is the reporter's population?
- A the number of people who live in the state
- B the people who were interviewed in the state
- C all voters over 25 years old in the state
- D all eligible voters in the state

- 13 In a set of test scores that are normally distributed, a test score of 76 is 3 standard deviations below the mean. A score of 88 is 1 standard deviation above the mean. What is the mean of the data?
- A 79
- B 82
- C 84
- D 85