Released Items

Student Booklet

Student Name: _____

Fall 2015
NC Final Exam
Math III

READY

Public Schools of North Carolina
State Board of Education
Department of Public Instruction
Raleigh, North Carolina 27699-6314

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 $\frac{25}{16}$

Go to the next page.

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

Go to the next page.

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 $\frac{3}{2}$

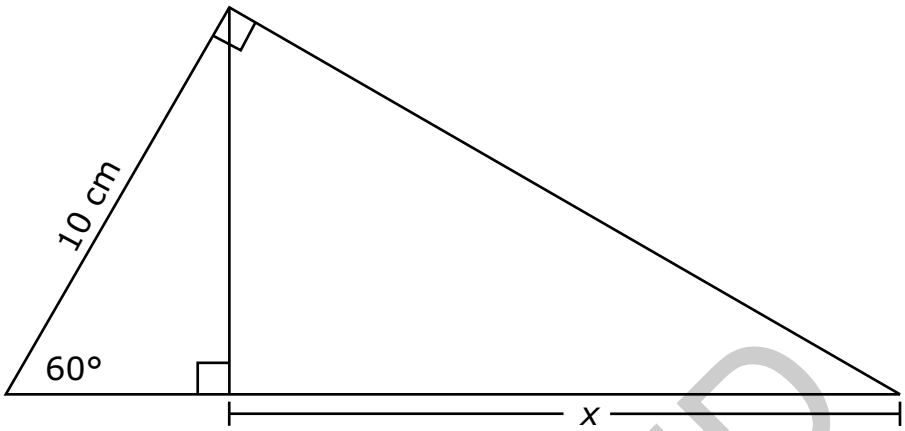
B 3

C 4

D 8π

Go to the next page.

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

Go to the next page.

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 ≈ 43,560 ft^2)

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

Go to the next page.

14 Which expression is equivalent to $\dfrac{\dfrac{\sin(\theta)}{\cos(\theta)} + \dfrac{\cos(\theta)}{\sin(\theta)}}{\dfrac{1}{\sin(\theta)}}$?

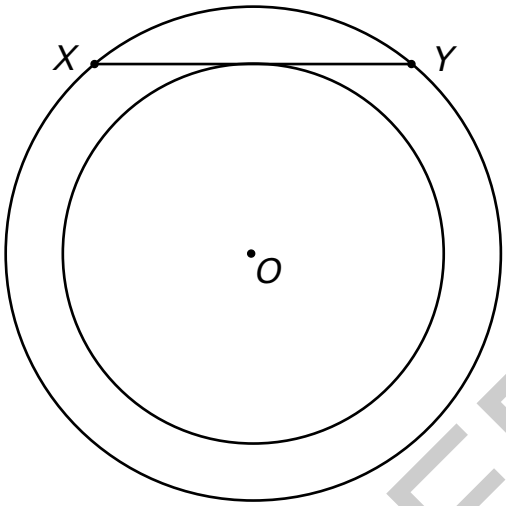
A $\dfrac{1}{\cos(\theta)}$

B $\sin(\theta)$

C $\cos(\theta)$

D $\dfrac{1}{\sin(\theta)}$

15 The figure below shows concentric circles, both centered at *O.*



- Chord *XY* is tangent to the smaller circle.
- The radius of the larger circle is 15 cm.
- The radius of the smaller circle is 12 cm.

What is the length of chord *XY*?

A 27 cm

B 24 cm

C 18 cm

D 10 cm

16 What is the ***approximate*** length of the arc subtended by an angle of $\frac{4\pi}{3}$ radians on a circle with a radius of 6.00 meters?

A 12.57 meters

B 14.14 meters

C 25.13 meters

D 28.27 meters

17 The length of a rectangular prism is $4\sqrt{3}$ units. The height is $3\sqrt{6}$ units. If the volume is irrational, which could be the measure of the width of the rectangular prism?

A $2\sqrt{50}$

B $4\sqrt{12}$

C $5\sqrt{8}$

D $7\sqrt{18}$

18 What is the solution to the equation $\frac{2x - 3}{x - 1} = \frac{8x + 1}{4x + 5}$?

A $^{-}\frac{14}{5}$

B $^{-}\frac{14}{9}$

C $\frac{14}{9}$

D $\frac{14}{5}$

Go to the next page.

19 Which function is equivalent to $y = x^2 - 6x + 10$?

A $y = (x + 3)^2 - 1$

B $y = (x - 3)^2 + 1$

C $y = (x + 6)^2 - 10$

D $y = (x - 6)^2 + 10$

20 Which expression is equivalent to $\frac{x + 7}{x^2 + 4x - 21} \div \frac{x + 5}{x^2 + 8x + 15}$ when x is restricted so that the expressions are defined?

A $\frac{x + 3}{x - 3}$

B $\frac{x - 3}{x + 3}$

C 1

D $^{-}1$

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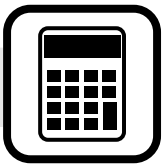

This is the end of the Math III Released Items.

Directions:

1. **Look back over your answers for the test questions.**
2. **Make sure all your answers are entered on the answer sheet. Only what is entered on your answer sheet will be scored.**
3. **Put all of your papers inside your test book and close the test book.**
4. **Place your calculator on top of the test book.**
5. **Stay quietly in your seat until your teacher tells you that testing is finished.**
6. **Remember, teachers are not allowed to discuss items from the test with you, and you are not allowed to discuss with others any of the test questions or information contained within the test.**

Math III
RELEASED Items[1]
Fall 2015
Answer Key

Item Number	Type[2]	Key	Percent Correct[3]	Standard
1	MC	B	51%	A.SSE.4
2	MC	B	41%	A.REI.11
3	MC	B	30%	A.REI.4.A
4	MC	A	28%	F.IF.5
5	MC	D	22%	F.IF.2
6	MC	B	22%	F.LE.3
7	MC	D	21%	F.TF.8
8	MC	B	15%	F.TF.1
9	MC	D	61%	G.SRT.5
10	MC	C	38%	G.MG.3
11	MC	D	36%	G.MG.3
12	MC	D	76%	S.IC.1
13	MC	D	49%	S.ID.4
14	MC	A	31%	F.TF.8
15	MC	C	38%	G.C.2

Item Number	Type[2]	Key	Percent Correct[3]	Standard
16	MC	C	60%	F.TF.1
17	MC	B	43%	N.RN.3
18	MC	D	43%	A.REI.2
19	MC	B	67%	A.SSE.3.b
20	MC	A	50%	A.APR.7

[1]These released items were administered to students during a previous test administration. This sample set of released items may not reflect the breadth of the standards assessed and/or the range of item difficulty found on the NC Final Exam. Additional information about the NC Final Exam is available in the *Assessment Specification* for each exam located at http://www.ncpublicschools.org/accountability/common-exams/specifications/.

[2]This NC Final Exam contains only multiple-choice (MC) items.

[3]Percent correct is the percentage of students who answered the item correctly during a previous administration.

Standard Descriptions

Only standard descriptions addressed by the released items in this booklet are listed below. A complete list of standards for English Language Arts and Mathematics may be reviewed at http://www.ncpublicschools.org/curriculum/mathematics/scos/.

N.RN.3 (High School: Numbers)
Use properties of rational and irrational numbers: Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

A.SSE.3.B (High School: Algebra)
Seeing Structure in Expressions: Write expressions in equivalent forms to solve problems. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

A.SSE.4 (High School: Algebra)
Seeing Structure in Expressions: Write expressions in equivalent forms to solve problems. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.

A.APR.7 (High School: Arithmetic with Polynomials and Rational Expressions)
Perform arithmetic operations on polynomials: Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

A.REI.2 (High School: Algebra)
Reasoning with Equations and Inequalities: Understand solving equations as a process of reasoning and explain the reasoning. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

A.REI.4.A (High School: Algebra)
Reasoning with Equations and Inequalities: Solve equations and inequalities in one variable. Solve quadratic equations in one variable: Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

A.REI.11 (High School: Algebra)
Reasoning with Equations and Inequalities: Represent and solve equations and inequalities graphically. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

F.IF.2 (High School: Functions)
Interpreting Functions: Understand the concept of a function and use function notation. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F.IF.5 (High School: Functions)
Interpreting Functions: Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

F.LE.3 (High School: Functions)
Linear, Quadratic, and Exponential Models: Construct and compare linear, quadratic, and exponential models and solve problems. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

F.TF.1 (High School: Functions)
Trigonometric Functions: Extend the domain of trigonometric functions using the unit circle. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

F.TF.8 (High School: Functions)
Trigonometric Functions: Prove and apply trigonometric identities. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.

G.SRT.5 (High School: Geometry)
Similarity, Right Triangles, and Trigonometry: Prove theorems involving similarity. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

G.C.2 (High School: Circles)
Understand and apply theorems about circles: Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle

G.MG.3 (High School: Geometry)
Modeling with Geometry: Apply geometric concepts in modeling situations. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

S.ID.4 (High School: Statistics and Probability)
Interpreting Categorical and Quantitative Data: Summarize, represent, and interpret data on a single count or measurement variable. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

S.IC.1 (High School: Statistics and Probability)
Making Inferences and Justifying Conclusions: Understand and evaluate random processes underlying statistical Experiments. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.