Released Items

Student Name: Key

NC Math 2

2017–2018

NC Final Exam

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

1 Which expression is equivalent to $\left(8w^{7}x^{-5}y^{3}z^{-9}\right)^{-\frac{2}{3}}$?

A $\dfrac{x^{\frac{10}{3}}z^{6}}{4w^{\frac{14}{3}}y^{2}}$

B $\dfrac{4w^{\frac{14}{3}}y^{2}}{x^{\frac{10}{3}}z^{6}}$

C $\dfrac{2w^{\frac{5}{3}}y^{\frac{1}{3}}}{x^{\frac{7}{3}}z^{\frac{11}{3}}}$

D $\dfrac{x^{\frac{7}{3}}z^{\frac{11}{3}}}{2w^{\frac{5}{3}}y^{\frac{1}{3}}}$

2 A marathon is roughly 26.2 miles long. Which equation could be used to determine the time, t, it takes to run a marathon as a function of the average speed, s, of the runner where t is in hours and s is in miles per hour?

A $t = 26.2 - 26.2s$

B $t = 26.2 - \dfrac{s}{26.2}$

C $t = 26.2s$

D $t = \dfrac{26.2}{s}$

① $(8w^{7}x^{-5}y^{3}z^{-9})^{-\frac{2}{3}}$ Power Rule!

$8^{-\frac{2}{3}} w^{-\frac{14}{3}} x^{\frac{10}{3}} y^{-2} z^{6}$ move negative exponents + simplify coefficient

$\frac{1}{4} \cdot \frac{1}{w^{\frac{14}{3}}} \cdot x^{\frac{10}{3}} \cdot \frac{1}{y^{2}} \cdot z^{6}$

$$\frac{x^{\frac{10}{3}} z^{6}}{4w^{\frac{14}{3}} y^{2}}$$

(A)

② 26.2 miles

t: time

s: speed (miles/hr)

$$S = \frac{26.2 \text{ miles}}{t \text{ hr.}}$$

$t \cdot S = \frac{26.2}{t} \cdot t$ solve for t!

$\frac{t \cdot S}{S} = \frac{26.2}{S}$

$$t = \frac{26.2}{s}$$

(D)

3 The force, F, acting on a charged object varies inversely to the square of its distance, r, from another charged object. When the two objects are 0.64 meter apart, the force acting on them is 8.2 Newtons. ***Approximately*** how much force would the object feel if it is at a distance of 0.77 meter from the other object?

A 1.7 Newtons

B 5.7 Newtons

C 11.9 Newtons

D 12.9 Newtons

4 A system of equations is shown below.

$$y = x^2 + 2x + 8$$
$$y = -4x$$

What is the smallest value of y in the solution set of the system?

A -4

B -2

C 8

D 16

(3) $F = \frac{K}{r^2}$

$8.2 = \frac{K}{(.64)^2}$

$8.2 = \frac{K}{.4096}$

$K = 3.35872$

↑ know goes together

$F = \frac{3.35872}{r^2}$ ← New equation

$F = \frac{3.35872}{(.77)^2}$

$F \approx$ 5.7 Newtons

↑ Solve for unknown!

(B)

(4) $y = x^2 + 2x + 8$

$y = -4x$

Substitution Method!

$-4x = x^2 + 2x + 8$

$0 = x^2 + 6x + 8$

$0 = (x+4)(x+2)$

Solved by Factoring ←

$x + 4 = 0$ $\quad x + 2 = 0$

$x = -4$ $\quad x = -2$

↓ ↓

$y = -4(-4)$ $\quad y = -4(-2)$

$y = 16$ $\quad y = 8$

smallest value of y:

8

(C)

5 The cost of a newspaper advertisement is a function of its size.

- A company wants its advertisement to have a height that is twice its width.
- The newspaper charges a flat rate of $50 plus an additional $10 per square inch.
- The company can spend no more than $2,050 on the advertisement.

What is the maximum height of an advertisement that the company can afford?

A 5 inches

B 10 inches

C 15 inches

D 20 inches

(5)

Price

$y = 50 + 10a$ ← area: square inches

$y \leq 2050$ ← no more than $2050 to spend

$a = w \cdot h$

$a = w(2w)$

$a = 2w^2$

$50 + 10(2w^2) \leq 2050$

$50 + 20w^2 \leq 2050$

$20w^2 + 50 \leq 2050$

$20w^2 \leq 2000$

$w^2 \leq 100$

$w \leq \pm 10$ ← ± when taking √

$w \leq 10$ ← eliminate negative since cannot have −$

Maximum width: 10 inches

Maximum height: 2(10)

= 20 inches

D

6 Farmer Brown built a rectangular pen for his chickens using 12 meters of fence.

- He used part of one side of his barn as one length of the rectangular pen.
- He maximized the area using the 12 meters of fence.

Farmer Johnson built a rectangular pen for her chickens using 16 meters of fence.

- She used part of one side of her barn as one length of the rectangular pen.
- The length of her pen was 2 meters more than the length of Farmer Brown's pen.
- The width of her pen was 1 meter more than the width of Farmer Brown's pen.

How much larger is Farmer Johnson's rectangular pen than Farmer Brown's?

A 24 square meters

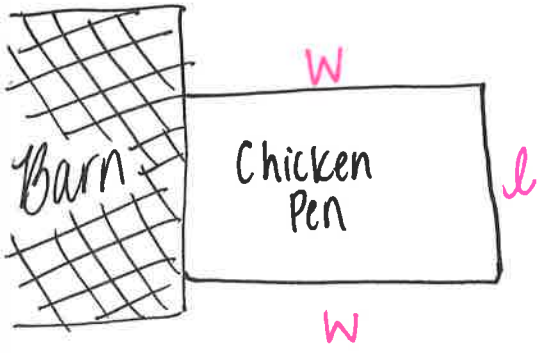
B 18 square meters

C 16 square meters

D 14 square meters

(6)

Farmer Brown



$2W + \ell = 12 \rightarrow \ell = -2W + 12$

maximized Area

$A = \ell \cdot W$

$A = (-2W + 12)(W)$

$A = -2W^2 + 12W$

maximum

(3, 18)

↑ W, ↑ area

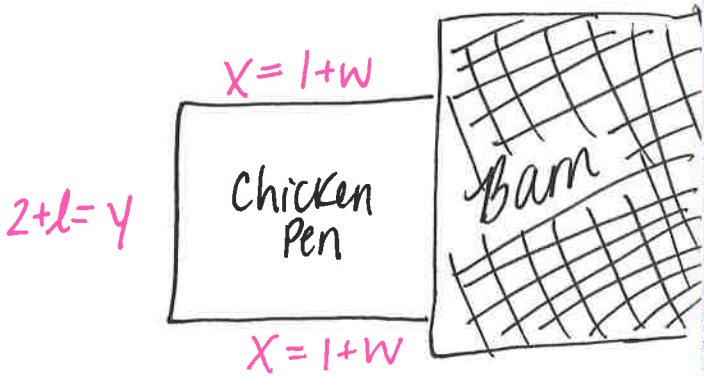
Need to adjust window!

$W = 3$ meters

$\ell = -2(3) + 12 = 6$ meters

Area $= (3)(6) = \underline{18 m^2}$

Farmer Johnson



$2(1+W) + 2 + \ell = 16$

$2 + 2W + 2\ell = 16$

↑ Not needed

$X = 1 + 3 = 4$ meters

$y = 2 + 6 = 8$ meters

Area $= (8)(4)$

$= \underline{32 m^2}$

Johnson's Area − Brown's Area

$32 - 18 = \boxed{14 m^2}$

(D)

7 Suppose that Jamal can choose to get home from work by taxi or bus.

- When he chooses to get home by taxi, he arrives home after 7 p.m. 8 percent of the time.
- When he chooses to get home by bus, he arrives home after 7 p.m. 15 percent of the time.
- Because the bus is cheaper, he uses the bus 60 percent of the time.

What is the ***approximate*** probability that Jamal chose to get home from work by bus, given that he arrived home after 7 p.m.?

A 0.09

B 0.14

C 0.60

D 0.74

8 The graph of $f(x) = 2x^2 - 3x + 5$ will be translated 8 units down, producing the graph of $q(x)$. Which equation represents the new function, $q(x)$?

A $q(x) = 2x^2 - 3x - 3$

B $q(x) = 2x^2 - 11x + 5$

C $q(x) = 2x^2 - 3x + 13$

D $q(x) = 2x^2 + 5x + 5$

(7)

	Taxi	Bus	TOTAL
Before 7	(.40)(.92) .368	(.60)(.85) .51	.878
After 7	(.40)(.08) .032	(.60)(.15) .09	.122
TOTAL	.40	.60	1

and given = bus ∩ after 7 / after 7

$\frac{.09}{.122} \approx .74$

D

(8) $f(x) = 2x^2 - 3x + 5$

↓ minimum

Vertex form: *reuse "a" value
*find vertex in calc.

$f(x) = 2(x-.75)^2 + 3.875$

OLD

NEW

$g(x) = 2(x-.75)^2 + 3.875 - 8$

$2(x-.75)^2 - 4.125$

$2(x-.75)(x-.75) - 4.125$

$2(x^2 - .75x - .75x + .5625) - 4.12$

$2x^2 - 1.5x - 1.5x + 1.125 - 4.125$

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

A

9 The equation $2x^2 - 5x = {}^{-}12$ is rewritten in the form of $2(x - p)^2 + q = 0$. What is the value of q?

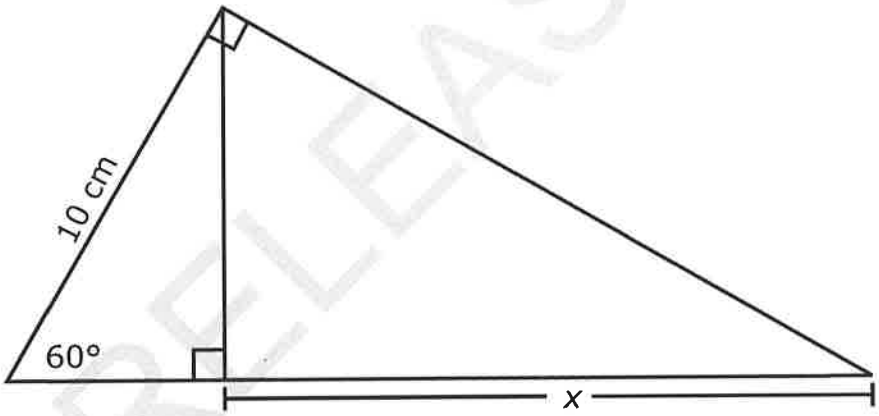
A $\frac{167}{16}$

B $\frac{71}{8}$

C $\frac{25}{8}$

D $\frac{25}{16}$

10 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

Go to the next page.

(9) $2x^2-5x=-12$

*complete the square!

by hand

$2x^2-5x = -12$

$2\left(x^2-\frac{5}{2}x+\boxed{\frac{25}{16}}\right) = -12+\boxed{\frac{25}{8}}$

$2\left(x-\frac{5}{4}\right)^2 = -\frac{71}{8}$

$2\left(x-\frac{5}{4}\right)^2+\frac{71}{8}=0$

$\boxed{\frac{71}{8}}$

$\left(\frac{b}{2}\right)^2$

$\left(\frac{5}{4}\right)^2=\frac{25}{16}$

w/ vertex in calc.

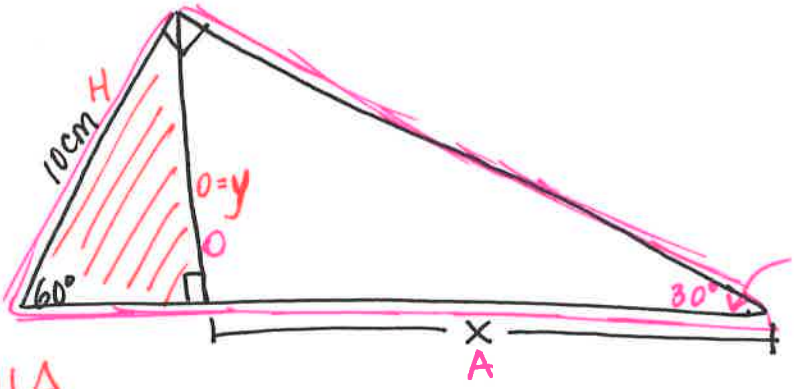
$2x^2-5x+12=0$

$2(x-1.25)^2+8.875=0$

$\boxed{\frac{71}{8}}$

(B)

(10)



$180-60-90=30°$

Small Δ

$\sin(60)=\frac{y}{10}$

$10\sin(60)=y$

Big Δ

$\tan(30)=\frac{y}{x}$

$\tan(30)=\frac{10\sin(60)}{x}$

☆ Degree Mode!!

$x\cdot\tan(30)=10\sin(60)$

$x=\frac{10\sin(60)}{\tan(30)}$

$x=\boxed{15\text{cm}}$

(D)

11 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 $7\sqrt{18}$

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

(11) length $= 4\sqrt{3}$ units
height $= 3\sqrt{6}$

volume $= l \cdot w \cdot h$ = irrational (cannot be fraction)

~~A~~ $2\sqrt{50}$: $V = (4\sqrt{3})(2\sqrt{50})(3\sqrt{6}) = 720 \text{ units}^3$

B $4\sqrt{12}$: $V = (4\sqrt{3})(4\sqrt{12})(3\sqrt{6}) \approx 705.45 \text{ units}^3$ ← NO fraction!

~~C~~ $5\sqrt{8}$: $V = (4\sqrt{3})(5\sqrt{8})(3\sqrt{6}) = 720 \text{ units}^3$

~~D~~ $7\sqrt{18}$: $V = (4\sqrt{3})(7\sqrt{18})(3\sqrt{6}) = 1512 \text{ units}^3$

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

~~A~~

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

$(x+3)(x+3) - 1$

$x^2 + 3x + 3x + 9 - 1$

$y = x^2 + 6x + 8$

B

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

$(x-3)(x-3) + 1$

$x^2 - 3x - 3x + 9 + 1$

$\boxed{y = x^2 - 6x + 10}$

(B)

~~C~~

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

$(x+6)(x+6) - 10$

$x^2 + 6x + 6x + 36 - 10$

$y = x^2 + 12x + 26$

~~D~~

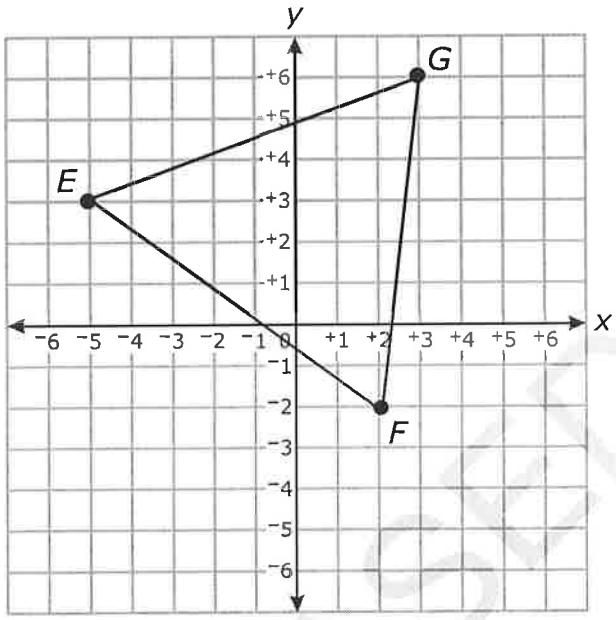
$y = (x-6)^2 + 10$

$(x-6)(x-6) + 10$

$x^2 - 6x - 6x + 36 + 10$

$y = x^2 - 12x + 46$

13 Triangle *EGF* is graphed below.



Triangle *EGF* will be rotated 90° counterclockwise around the origin and will then be reflected across the *y*-axis, producing an image triangle. Which additional transformation will map the image triangle back onto the original triangle?

A rotation 270° counterclockwise around the origin

B rotation 180° counterclockwise around the origin

C reflection across the line $y = -x$

D reflection across the line $y = x$

(13)

	Rotate 90° $(-y, x)$	Reflect y-axis $(-x, y)$
$E(-5,3)$	$(-3,-5)$	$(3,-5)$
$F(2,-2)$	$(2,2)$	$(-2,2)$
$G(3,6)$	$(-6,3)$	$(6,3)$

~~A~~ Rotate 270° $(y, -x)$

$(3,-5) \rightarrow (-5,-3)$

$(-2,2) \rightarrow (2,2)$

$(6,3) \rightarrow (3,-6)$

~~B~~ Rotate 180° $(-x, -y)$

$(3,-5) \rightarrow (-3,5)$

$(-2,2) \rightarrow (2,-2)$

$(6,3) \rightarrow (-6,-3)$

C reflect $y=-x$

$(3,-5)$

$(-2,2)$

$(6,3)$

D reflect $y=x$ (y, x)

$(3,-5) \rightarrow (-5,3)$

$(-2,2) \rightarrow (2,-2)$

$(6,3) \rightarrow (3,6)$

(D)

This is the end of the NC Math 2 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.**

NC Math 2
RELEASED Items[1]
2017–2018
Answer Key

Item Number	Type[2]	Key	Percent Correct[3]	Standard
1	MC	A	37%	N-RN.2
2	MC	D	67%	A-CED.2
3	MC	B	40%	A-REI.2
4	MC	C	33%	A-REI.7
5	MC	D	47%	F-IF.8
6	MC	D	35%	F-BF.1
7	MC	D	20%	S-CP.6
8	MC	A	61%	F-BF.3
9	MC	B	30%	A-REI.4a
10	MC	D	61%	G-SRT.8
11	MC	B	46%	N-RN.3
12	MC	B	67%	A-SSE.3
13	MC	D	23%	G-CO.5

[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 Specifications* 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 Mathematics may be reviewed at
http://www.ncpublicschools.org/curriculum/mathematics/scos/.

N-RN.2 (Number and Quantity)
The Real Number System: Extend the properties of exponents to rational exponents.
Rewrite expressions with radicals and rational exponents into equivalent expressions using the properties of exponents.

N-RN.3 (Number and Quantity)
The Real Number System: Use properties of rational and irrational numbers.
Use the properties of rational and irrational numbers to explain why:

- the sum or product of two rational numbers is rational;
- the sum of a rational number and an irrational number is irrational;
- the product of a nonzero rational number and an irrational number is irrational

A-SSE.3 (Algebra)
Seeing Structure in Expressions: Interpret the structure of expressions.
Write an equivalent form of a quadratic expression by completing the square, where a is an integer of a quadratic expression, $ax^2 + bx + c$, to reveal the maximum or minimum value of the function the expression defines.

A-CED.2 (Algebra)
Creating Equations: Create equations that describe numbers or relationships.
Create and graph equations in two variables to represent quadratic, square root and inverse variation relationships between quantities.

A-REI.2 (Algebra)
Reasoning with Equations and Inequalities: Understand solving equations as a process of reasoning and explain the reasoning.
Solve and interpret one variable inverse variation and square root equations arising from a context, and explain how extraneous solutions may be produced

A-REI.4a (Algebra)
Reasoning with Equations and Inequalities: Solve equations and inequalities in one variable.
Solve for all solutions of quadratic equations in one variable.
Understand that the quadratic formula is the generalization of solving $ax^2 + bx + c$ by using the process of completing the square.

A-REI.7 (Algebra)
Reasoning with Equations and Inequalities: Solve systems of equations.
Use tables, graphs, and algebraic methods to approximate or find exact solutions of systems of linear and quadratic equations, and interpret the solutions in terms of a context.

F-IF.8 (Functions)
Interpreting Functions: Analyze functions using different representations.
Use equivalent expressions to reveal and explain different properties of a function by developing and using the process of completing the square to identify the zeros, extreme values, and symmetry in graphs and tables representing quadratic functions, and interpret these in terms of a context.

F-BF.1 (Functions)
Building Functions: Build a function that models a relationship between two quantities.
Write a function that describes a relationship between two quantities by building quadratic functions with real solution(s) and inverse variation functions given a graph, a description of a relationship, or ordered pairs (include reading these from a table).

F-BF.3 (Functions)
Building Functions: Build new functions from existing functions.
Understand the effects of the graphical and tabular representations of a linear, quadratic, square root, and inverse variation function f with $k \bullet f(x)$, $f(x) + k$, $f(x + k)$ for specific values of k (both positive and negative).

G-CO.5 (Geometry)
Congruence: Experiment with transformations in the plane.
Given a geometric figure and a rigid motion, find the image of the figure. Given a geometric figure and its image, specify a rigid motion or sequence of rigid motions that will transform the pre-image to its image.

G-SRT.8 (Geometry)
Similiarity, Right Triangles, and Trigonometry: Define trigonometric ratios and solve problems involving right triangles.
Use trigonometric ratios and the Pythagorean Theorem to solve problems involving right triangles in terms of a context.

S-CP.6 (Statistics and Probability)
Conditional Probability and the Rules of Probability: Use the rules of probability to compute probabilities of compound events in a uniform probability model.
Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in context.