

Released Items

Student Name: \_\_\_\_\_

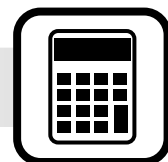
Fall 2015  
NC Final Exam  
**Precalculus**



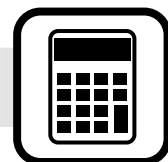
# Student Booklet



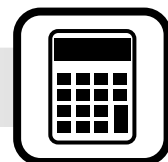
Public Schools of North Carolina  
State Board of Education  
Department of Public Instruction  
Raleigh, North Carolina 27699-6314



- 1 What transformations have occurred to create the function  $f(x) = 3x^3 - 4$  from the function  $g(x) = x^3$ ?
- A The graph of the function has been stretched horizontally and shifted up four units.
  - B The graph of the function has been stretched vertically and shifted up four units.
  - C The graph of the function has been stretched horizontally and shifted down four units.
  - D The graph of the function has been stretched vertically and shifted down four units.
- 2 An object is launched straight upward from ground level with an initial velocity of 50.0 feet per second. The height,  $h$  (in feet above ground level), of the object  $t$  seconds after the launch is given by the function  $h(t) = -16t^2 + 50t$ . At **approximately** what value of  $t$  will the object have a height of 28.0 feet and be traveling downward?
- A 2.39 seconds
  - B 1.84 seconds
  - C 1.56 seconds
  - D 0.73 seconds
- 3 What is the range of the function  $f(x) = -5 - 2(x + 3)^2$ ?
- A  $[-5, \infty)$
  - B  $(-\infty, 5]$
  - C  $(-\infty, -5]$
  - D  $(-\infty, \infty)$



- 4 A wind that is blowing from the northwest toward the southeast can be represented by a vector. The vector has an eastward component and a southward component. If the eastward component has a magnitude of 5.00 miles per hour and the southward component has a magnitude of 15.00 miles per hour, in what direction is the wind blowing?
- A The wind is blowing in the direction  $71.6^\circ$  east of south.
- B The wind is blowing in the direction  $67.5^\circ$  east of south.
- C The wind is blowing in the direction  $22.5^\circ$  east of south.
- D The wind is blowing in the direction  $18.4^\circ$  east of south.
- 5 What value of  $x$  satisfies the equation  $\log_3(x - 4) = 2$ ?
- A 5
- B 10
- C 12
- D 13
- 6 A man is standing on level ground 50 feet away from the wall of a building. He looks up at a window on the building. The angle of elevation to the bottom of the window is  $28.5^\circ$ . He then looks up at the top of the building. The angle of elevation to the top of the building is  $35^\circ$ . What is the **approximate** distance between the bottom of the window and the top of the building?
- A 5.7 feet
- B 7.9 feet
- C 8.3 feet
- D 8.5 feet



7 Triangle  $WXY$  has the following properties:

- The angle at vertex  $W$  is  $14^\circ$ , and the angle at vertex  $X$  is obtuse.
- The side opposite vertex  $W$  has a length of 7.00 units.
- The side opposite vertex  $X$  has a length of 9.00 units.

What is the **approximate** length of the side opposite vertex  $Y$ ?

- A 1.73 units
- B 2.08 units
- C 3.26 units
- D 5.40 units

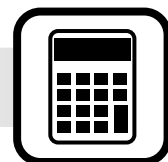
8 Consider these two trigonometric functions:

$$f(x) = 3 \sin(2x) + 4$$

$$g(x) = 3 \sin\left(2x - \frac{\pi}{2}\right) + 4$$

How should the graph of  $f$  be shifted to produce the graph of  $g$ ?

- A Shift the graph of  $f$  to the left  $\frac{\pi}{4}$  units to produce the graph of  $g$ .
- B Shift the graph of  $f$  to the right  $\frac{\pi}{4}$  units to produce the graph of  $g$ .
- C Shift the graph of  $f$  to the left  $\frac{\pi}{2}$  units to produce the graph of  $g$ .
- D Shift the graph of  $f$  to the right  $\frac{\pi}{2}$  units to produce the graph of  $g$ .



- 9 The maximum height, in inches, a ball reaches after its first four bounces is shown in the table below.

Bounce Number	Height (in inches)
1	42.0
2	31.5
3	23.6
4	17.7

Which type of function **best** models the data and why?

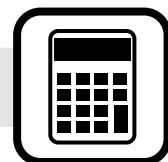
- A an exponential function, because the height of the ball is decreasing by 25% with each bounce
- B an exponential function, because the height of the ball is decreasing by 75% with each bounce
- C a logistic function, because the height of the ball is decreasing by 25% with each bounce
- D a logistic function, because the height of the ball is decreasing by 75% with each bounce
- 10 What is the inverse function of  $g(x) = x^3 - 2$ ?

A  $g^{-1}(x) = \sqrt[3]{x + 2}$

B  $g^{-1}(x) = \sqrt[3]{x - 2}$

C  $g^{-1}(x) = \sqrt[3]{x} + 2$

D  $g^{-1}(x) = \left(\frac{x - 2}{3}\right)^3$



- 11 What are the polar coordinates of the point  $(-2\sqrt{3}, 2\sqrt{3})$ , where  $0 \leq \theta \leq 360$ ?
- A  $(2\sqrt{6}, 150^\circ)$  and  $(-2\sqrt{6}, 210^\circ)$
- B  $(2\sqrt{6}, 135^\circ)$  and  $(-2\sqrt{6}, 315^\circ)$
- C  $(2\sqrt{6}, 120^\circ)$  and  $(-2\sqrt{6}, 240^\circ)$
- D  $(2\sqrt{6}, 30^\circ)$  and  $(-2\sqrt{6}, 330^\circ)$
- 12 Which equation is the rectangular form of the polar equation  $r = \frac{2}{1 + \cos \theta}$ ?
- A  $x^2 + 4y = 4$
- B  $x^2 + y^2 = 4$
- C  $y^2 + 4x = 4$
- D  $y^2 - 4x = 4$



- 13 Two parametric equations are shown below, where  $t \geq 0$ .

$$x = \frac{1}{3}\sqrt{t} + 3$$

$$y = 4t^2 - 7$$

Which nonparametric equation can be used to graph the curve described by the parametric equations?

A  $y = \frac{4}{9}(x + 1) - 7$

B  $y = \frac{4}{3}(x + 3) - 7$

C  $y = 36(x - 1)^4 - 7$

D  $y = 324(x - 3)^4 - 7$

- 14 The formula for a sequence is shown below.

$$a_n = 2a_{n-1} + 3, a_1 = 3$$

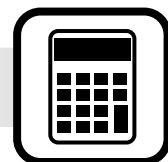
Which is another formula that represents the sequence?

A  $f(n) = 3(2^n - 1)$

B  $f(n) = 2n^3 - 3n^2 + 8n + 3$

C  $f(n) = 2(n^2 + 1)$

D  $f(n) = 3n^2 + 8n - 1$



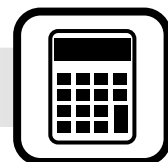
15 When  $a_1 = 25,000$ , what is the sum of the infinite sequence defined by the equation  $a_{n+1} = 0.8a_n$ ?

- A 125,000
- B 140,000
- C 160,000
- D 195,000

16 What is the end behavior of the function  $f(x) = \frac{100}{1 + 5(0.75)^x}$ ?

- A  $\lim_{x \rightarrow -\infty} f(x) = 0$  and  $\lim_{x \rightarrow \infty} f(x) = \infty$
- B  $\lim_{x \rightarrow -\infty} f(x) = 0$  and  $\lim_{x \rightarrow \infty} f(x) = 100$
- C  $\lim_{x \rightarrow -\infty} f(x) = 1$  and  $\lim_{x \rightarrow \infty} f(x) = \infty$
- D  $\lim_{x \rightarrow -\infty} f(x) = 1$  and  $\lim_{x \rightarrow \infty} f(x) = 100$





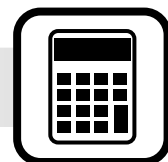
- 17 In the piecewise function below,  $k$  is a constant.

$$f(x) = \begin{cases} \frac{x^2 - k^2}{x - k}, & x \neq k \\ 4 - k, & x = k \end{cases}$$

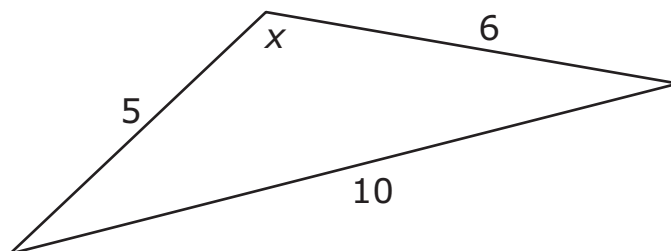
What is the value of the limit  $\lim_{x \rightarrow k^-} f(x)$ ?

- A  $-2k$   
B  $2k$   
C  $0$   
D Limit does not exist.
- 18 What is the value of  $\lim_{x \rightarrow 3} (x^2 - 3x + 7)$ ?

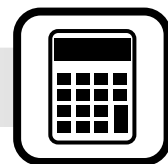
- A  $-2$   
B  $7$   
C  $25$   
D Limit does not exist.



- 19 What is the **approximate** measure of angle  $x$  in the triangle below?



- A 60.3°  
 B 80.4°  
 C 117.1°  
 D 130.5°
- 20 The temperature, in degrees F, of the water in a large fish tank is modeled by the function  $T(x) = \ln(1 + x) + 52.4$ , where  $x$  is the number of pebbles in the tank. **Approximately** how many pebbles are in the tank if the water is 58.3°F?
- A 360  
 B 300  
 C 270  
 D 200



- 21 A series is shown below.

$$1 + \frac{2}{5} + \frac{4}{25} + \frac{8}{125} + \dots$$

Which statement is true about the sum of the series?

- A The series converges to  $\frac{7}{3}$ .
- B The series converges to  $\frac{5}{2}$ .
- C The series converges to  $\frac{5}{3}$ .
- D The series diverges.
- 22 A circle is graphed using the parametric equations shown below.

$$x = 5\cos(t) + 3$$

$$y = 5\sin(t) - 1$$

Where is the center of the circle located?

- A  $(-3, -1)$
- B  $(-3, 1)$
- C  $(3, -1)$
- D  $(3, 1)$



- 23 The polar coordinates of a point are  $\left(6, \frac{4\pi}{3}\right)$ . What are the rectangular coordinates of the point?
- A  $(3, -3\sqrt{3})$
  - B  $(3, 3\sqrt{3})$
  - C  $(-3, -3\sqrt{3})$
  - D  $(-3, 3\sqrt{3})$

RELEASED

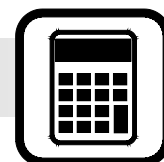


**This is the end of the Precalculus Released Items.**

**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.**

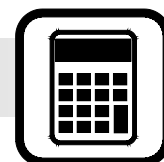
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Precalculus  
 RELEASED Items<sup>1</sup>  
 Fall 2015  
 Answer Key

Item Number	Type <sup>2</sup>	Key	Percent Correct <sup>3</sup>	Standard
1	MC	D	67%	1.01
2	MC	A	67%	1.02.a
3	MC	C	58%	1.02.b
4	MC	D	28%	1.03
5	MC	D	73%	2.01.a
6	MC	B	64%	2.02.a
7	MC	B	30%	2.02.c
8	MC	B	24%	2.02.b
9	MC	A	52%	2.03.a
10	MC	A	67%	2.04
11	MC	B	58%	2.05.a
12	MC	C	45%	2.05.a
13	MC	D	43%	2.06
14	MC	A	73%	2.07.d
15	MC	A	61%	2.07.b
16	MC	B	47%	2.08
17	MC	B	23%	2.08

# PRECALCULUS — RELEASED ITEMS

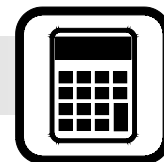


Item Number	Type <sup>2</sup>	Key	Percent Correct <sup>3</sup>	Standard
18	MC	B	73%	2.08
19	MC	D	56%	2.02.c
20	MC	A	81%	2.01.a
21	MC	C	43%	2.07.c
22	MC	C	62%	2.06
23	MC	C	62%	2.05.a

<sup>1</sup>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/>.

<sup>2</sup>This NC Final Exam contains only multiple-choice (MC) items.

<sup>3</sup>Percent correct is the percentage of students who answered the item correctly during a previous administration.



## Standard Descriptions

This NC Final Exam is aligned to the 2003 Standard Course of Study. Only standard descriptions addressed by the released items in this booklet are listed below. A complete list of standards may be reviewed at <http://maccss.ncdpi.wikispaces.net/High+School>.

### 1.01

Transform relations in two dimensions; describe the results algebraically and geometrically.

### 1.02.a

Use the quadratic relations (parabola, circle, ellipse, hyperbola) to model and solve problems; justify results: Solve using tables, graphs, and algebraic properties.

### 1.02.b

Use the quadratic relations (parabola, circle, ellipse, hyperbola) to model and solve problems; justify results: Interpret the constants and coefficients in the context of the problem.

### 1.03

Operate with vectors in two dimensions to model and solve problems.

### 2.01.a

Use functions (polynomial, power, rational, exponential, logarithmic, logistic, piecewise-defined, and greatest integer) to model and solve problems; justify results: Solve using graphs and algebraic properties.

### 2.02.a

Use trigonometric and inverse trigonometric functions to model and solve problems; justify results: Solve using graphs and algebraic properties.

### 2.02.b

Use trigonometric and inverse trigonometric functions to model and solve problems; justify results: Create and identify transformations with respect to period, amplitude, and vertical and horizontal shifts.

### 2.02.c

Use trigonometric and inverse trigonometric functions to model and solve problems; justify results: Develop and use the law of sines and the law of cosines.

### 2.03.a

For sets of data, create and use calculator-generated models of linear, polynomial, exponential, trigonometric, power, logistic, and logarithmic functions: Interpret the constants, coefficients, and bases in the context of the data.

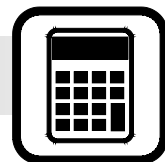
### 2.04

Use the composition and inverse of functions to model and solve problems.

### 2.05.a

Use polar equations to model and solve problems: Solve using graphs and algebraic properties.



**2.06**

Use parametric equations to model and solve problems.

**2.07.b**

Use recursively-defined functions to model and solve problems: Find the sum of an infinite sequence.

**2.07.c**

Use recursively-defined functions to model and solve problems: Determine whether a given series converges or diverges.

**2.07.d**

Use recursively-defined functions to model and solve problems: Translate between recursive and explicit representations.

**2.08**

Explore the limit of a function graphically, numerically, and algebraically.

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