Released Items

Student Name: ______________________

Fall 2015

NC Final Exam

Advanced Functions and Modeling

READY

Student Booklet

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

1 Suppose the function $H(t) = 8.5\sin(0.017t - 1.35) + 12$ models the hours of sunlight for a town in Alaska, where $t = 1$ is the first day of the year. Based on the function, what is the ***approximate*** range of daylight hours for the town?

A 3.5 to 20.5

B 4 to 20

C 4.5 to 19.5

D 5 to 19

2 The lifetime of a particular type of car tire is normally distributed. The mean lifetime is 50,000 miles, with a standard deviation of 5,000 miles. Of a random sample of 15,000 tires, how many of the tires are expected to last for between 45,000 and 55,000 miles?

A 7,125

B 10,200

C 14,250

D 14,850

Go to the next page.

3 The frequency table below shows the number of runners in specific age groups for a certain race.

Age Group	Number of Runners
0–10	||
11–20	|
21–30	𝍸 𝍸 ||
31–40	𝍸 |
41–50	𝍸
51–60	|
61–70	||
71–80	|
81–90	||

What is the shape of the distribution?

A uniform

B skewed right

C skewed left

D normal

Go to the next page.

4 A spinner labeled 1 to 9 gives each of the numbers 2, 5, 7, and 9 a $\frac{3}{20}$ chance of being landed upon. The chance of landing on each of the other five numbers is equal. If the spinner is spun 1,000 times, which choice is the ***most likely*** outcome for the 1,000 spins?

A

Number on Spinner	1	2	3	4	5	6	7	8	9
Number of Occurrences	110	112	111	111	109	112	112	111	112

B

Number on Spinner	1	2	3	4	5	6	7	8	9
Number of Occurrences	82	148	78	80	149	79	151	81	152

C

Number on Spinner	1	2	3	4	5	6	7	8	9
Number of Occurrences	120	122	100	103	108	126	113	104	104

D

Number on Spinner	1	2	3	4	5	6	7	8	9
Number of Occurrences	121	100	119	120	102	120	98	121	99

5 A group of 12 people need to form a line. The line will consist of exactly 9 of the people. Person X and Person Y have to be either third or fourth in line. How many different orders are possible?

A 79,833,600

B 1,209,600

C 604,800

D 362,880

6 The probability that it will rain on Saturday is $\frac{2}{3}$. The probability that the temperature on Saturday will reach 100°F is $\frac{4}{9}$. The probability that it will rain or reach 100°F on Saturday is $\frac{4}{5}$. What is the probability it will rain and reach 100°F on Saturday?

A $\frac{14}{45}$

B $\frac{16}{45}$

C $\frac{24}{45}$

D $\frac{26}{45}$

7 A manufacturing plant produces a special kind of lightbulb.

- Each lightbulb produced has a 0.040 probability of being defective.
- Five lightbulbs are chosen at random from the production line.

To the nearest thousandth, what is the probability that exactly two of the five bulbs will be defective?

A 0.014

B 0.016

C 0.018

D 0.020

8 What is the meaning of the base of the function $y = -\log(x)$?

A As y decreases by 1, x increases by a factor of 10.

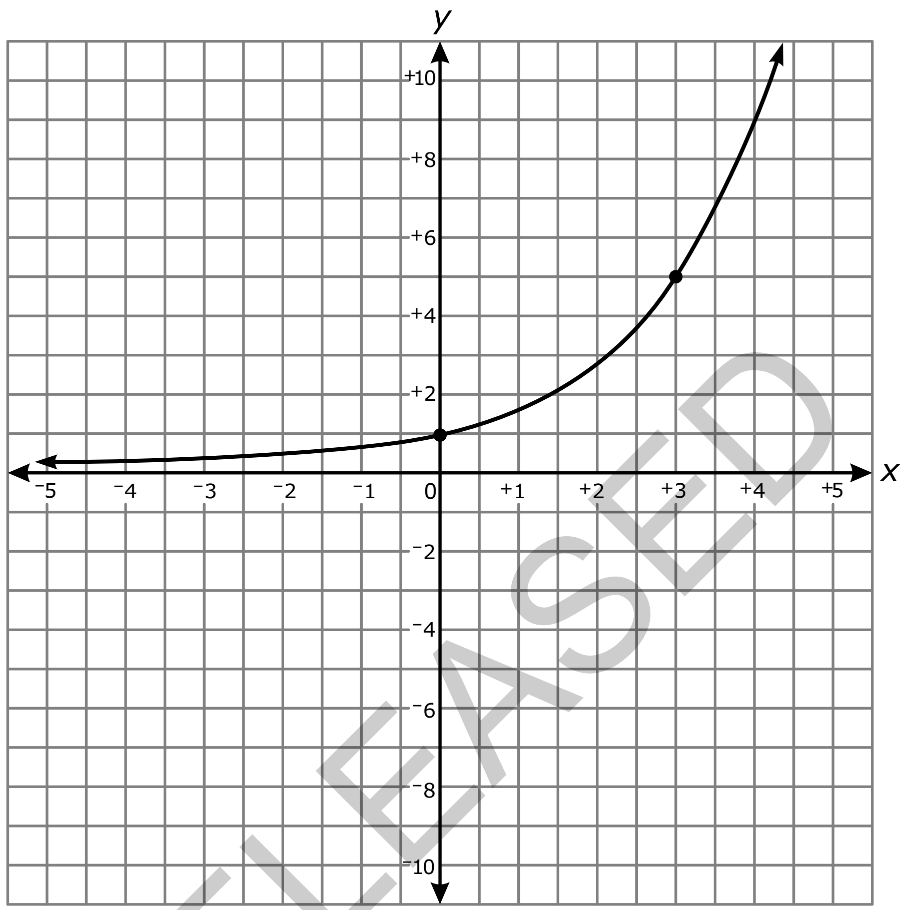
B As y decreases by 1, x increases by 10.

C As y increases by 1, x increases by a factor of 10.

D As y increases by 1, x increases by 10.

Go to the next page.

9 The graph of $y = a^x$ is shown below.



Which choice is closest to $\log_a 3$?

A 0.9

B 2.1

C 3.2

D 4.8

10 A piecewise function is shown below.

$$h(x) = \begin{cases} {}^{-}2x^2 + 5x + 10 & \text{for } {}^{-}4 \le x < 3 \\ 2x + 3p & \text{for } 3 \le x \le 5 \end{cases}$$

For what value of p will the function be continuous?

A $\frac{10}{3}$

B $\frac{1}{3}$

C ${}^{-}\frac{25}{3}$

D ${}^{-}\frac{34}{3}$

11 The equation $y = 4.7x^{\frac{1}{6}}$ is graphed on the coordinate plane. How does increasing the denominator of the exponent transform the graph?

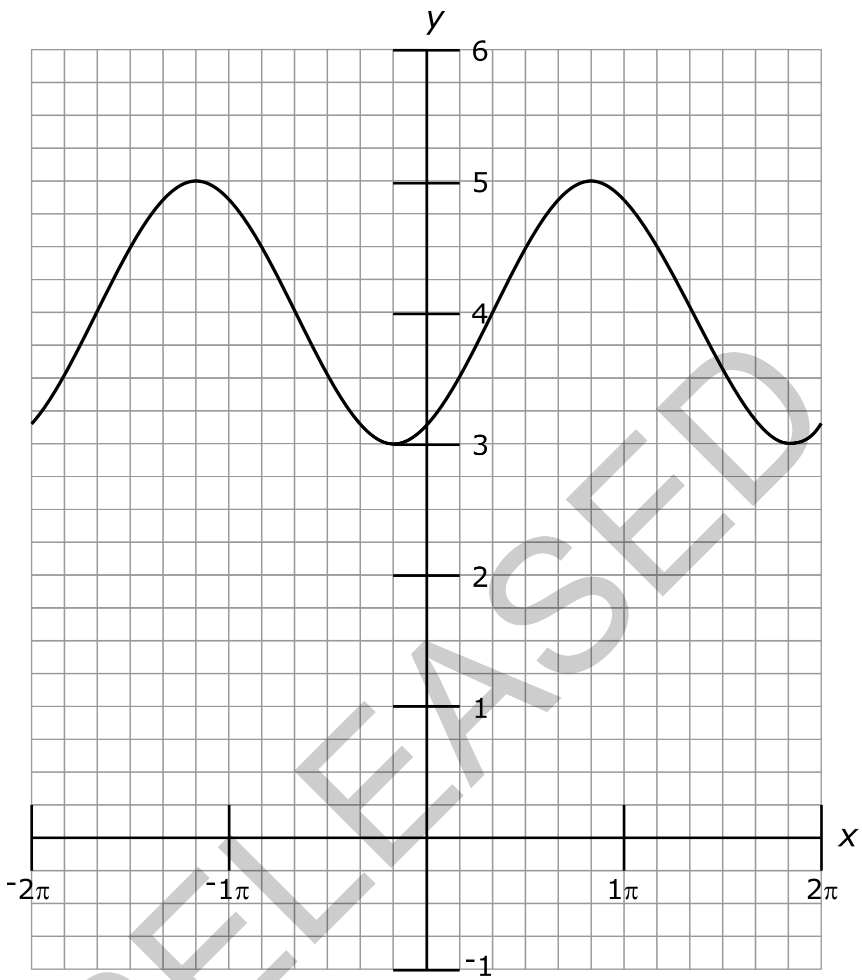
A The transformed graph will approach a horizontal asymptote while the original graph will not.

B The transformed graph will not approach a horizontal asymptote while the original graph will.

C The transformed graph will go to ∞ slower than the original graph as the value of x gets larger.

D The transformed graph will go to ∞ faster than the original graph as the value of x gets larger.

12 Which function correctly represents the graph below?



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

B $y = \sin\left(x + \frac{\pi}{3}\right) + 4$

C $y = \cos\left(x - \frac{\pi}{3}\right) + 4$

D $y = \cos\left(x + \frac{\pi}{3}\right) + 4$

13 Which function has an amplitude that is twice the size and a period that is three times the size of the function $y = 3\cos\left(\frac{x}{4} - 1\right) + 2$?

A $y = 6\sin\left(\frac{x}{12} - 3\right) + 1$

B $y = \frac{3}{2}\cos\left(\frac{3x}{4} + 1\right) - 3$

C $y = 6\cos\left(\frac{3x}{4} - 1\right) + 3$

D $y = \frac{3}{2}\sin\left(\frac{x}{12} + 3\right) - 1$

14 A plane takes off and travels at an angle of 40° north of east at 110 mph for 2 hours. It then adjusts its path to head 10° west of north and travels in that direction for half an hour at a speed of 100 mph. ***Approximately*** how far away is the plane from its starting point?

A 182 miles

B 200 miles

C 238 miles

D 249 miles

15 Which statement is true about the fifth terms of the two sequences below?

$$a_n = 3n^2 - 6$$

$$b_n = 3(b_{n-1} - 6);\ b_1 = 10$$

A The fifth term of the recursive sequence exceeds the fifth term of the explicit sequence by 63.

B The fifth term of the explicit sequence exceeds the fifth term of the recursive sequence by 63.

C The fifth term of the recursive sequence exceeds the fifth term of the explicit sequence by 21.

D The fifth term of the explicit sequence exceeds the fifth term of the recursive sequence by 21.

16 Which statement is true about the series shown below?

$$^{-}4 + {}^{-}2 + {}^{-}1 + \frac{^{-}1}{2} + \frac{^{-}1}{4} + \ldots$$

A The series converges because $|r| < 1$.

B The series diverges because $|r| < 1$.

C The series converges because $|r| > 1$.

D The series diverges because $|r| > 1$.

17 What is the explicit form of the equation $a_n = a_{n-1} + 2(n - 1)$; $a_1 = 1$?

A $a_n = 2n - 1$

B $a_n = n^2 - n + 1$

C $a_n = n^2 - 2n + 2$

D $a_n = 2n^2 - 2n - 1$

18 An investor bought 1,500 shares of a stock for $6 a share. He estimates the probability that the stock will rise to a value of $25 a share is 24%, and the probability it will fall to $2 a share is 76%. What is the expected value of the investor's profit from buying the stock?

A $13,560

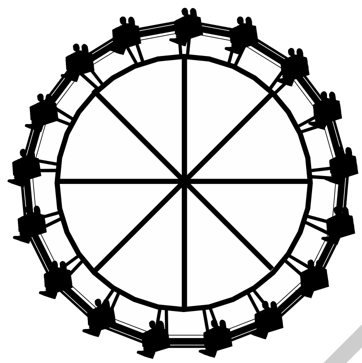
B $9,120

C $6,720

D $2,280

Go to the next page.

19 A Ferris wheel is designed in such a way that the height (h), in feet, of the seat above the ground at any time, t, is modeled by the function $h(t) = 60 - 55\sin\left(\frac{\pi}{10}t + \frac{\pi}{2}\right)$.



What is the ***maximum*** height a seat reaches?

A 55 feet

B 60 feet

C 110 feet

D 115 feet

20 A teacher counts the final exam as 25% of each student's class grade. The remaining 75% is the mean of the student's test scores from the semester. Jaleesa's test scores for the semester are 86, 90, 92, and 80. What is the ***minimum*** score Jaleesa must get on the final exam to have a class grade of 85.0 or higher?

A 77

B 79

C 81

D 83

Go to the next page.

21 Two sides of a triangle measure 10 inches and 13 inches. The included angle between these sides is 55°. What is the ***approximate*** measure of the third side of the triangle?

A 10.9 inches

B 11.2 inches

C 13.9 inches

D 16.2 inches

22 The third term of a geometric sequence is 96, and the fifth term is 1,536. What is the sum of the first ten terms of this sequence?

A 4,092

B 1,572,864

C 2,097,150

D 33,554,400

Go to the next page.

This is the end of the Advanced Functions and Modeling 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.**

Advanced Functions and Modeling
RELEASED Items[1]
Fall 2015
Answer Key

Item Number	Type[2]	Key	Percent Correct[3]	Standard
1	MC	A	50%	1.01.a
2	MC	B	48%	1.02.d
3	MC	B	37%	1.02.e
4	MC	B	39%	1.03.c
5	MC	B	21%	1.03.b
6	MC	A	20%	1.03.a
7	MC	A	19%	1.03.f
8	MC	A	45%	2.01.b
9	MC	B	29%	2.01.a
10	MC	B	42%	2.02.a
11	MC	C	34%	2.03.b
12	MC	A	43%	2.04.a
13	MC	A	29%	2.04.b
14	MC	D	23%	2.04.c
15	MC	C	37%	2.05.d
16	MC	A	30%	2.05.c
17	MC	B	17%	2.05.d

Item Number	Type[2]	Key	Percent Correct[3]	Standard
18	MC	D	24%	1.03.d
19	MC	D	25%	2.04.a
20	MC	B	27%	1.02.c
21	MC	A	25%	2.04.c
22	MC	C	49%	2.05.a

[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

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.a
Create and use calculator-generated models of linear, polynomial, exponential, trigonometric, power, and logarithmic functions of bivariate data to solve problems: Interpret the constants, coefficients, and bases in the context of the data.

1.02.c
Summarize and analyze univariate data to solve problems: Determine measures of central tendency and spread.

1.02.d
Summarize and analyze univariate data to solve problems: Recognize, define, and use the normal distribution curve.

1.02.e
Summarize and analyze univariate data to solve problems: Interpret graphical displays of univariate data.

1.03.a
Use theoretical and experimental probability to model and solve problems: Use addition and multiplication principles.

1.03.b
Use theoretical and experimental probability to model and solve problems: Calculate and apply permutations and combinations.

1.03.c
Use theoretical and experimental probability to model and solve problems: Create and use simulations for probability models.

1.03.d
Use theoretical and experimental probability to model and solve problems: Find expected values and determine fairness.

1.03.f
Use theoretical and experimental probability to model and solve problems: Apply the Binomial Theorem.

2.01.a
Use logarithmic (common, natural) functions to model and solve problems; justify results: Solve using tables, graphs, and algebraic properties.

2.01.b
Use logarithmic (common, natural) functions to model and solve problems; justify results: Interpret the constants, coefficients, and bases in the context of the problem.

2.02.a
Use piecewise-defined functions to model and solve problems; justify results: Solve using tables, graphs, and algebraic properties.

2.03.b
Use power functions to model and solve problems; justify results: Interpret the constants, coefficients, and bases in the context of the problem.

2.04.a
Use trigonometric (sine, cosine) functions to model and solve problems; justify results: Solve using tables, graphs, and algebraic properties.

2.04.b
Use trigonometric (sine, cosine) functions to model and solve problems; justify results: Create and identify transformations with respect to period, amplitude, and vertical and horizontal shifts.

2.04.c
Use trigonometric (sine, cosine) functions to model and solve problems; justify results: Develop and use the law of sines and the law of cosines.

2.05.a
Use recursively-defined functions to model and solve problems: Find the sum of a finite sequence.

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

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