Fall 2015
NC Final Exam
Precalculus

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° east of south.

B The wind is blowing in the direction 67.5° east of south.

C The wind is blowing in the direction 22.5° east of south.

D The wind is blowing in the direction 18.4° 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°. He then looks up at the top of the building. The angle of elevation to the top of the building is 35°. 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°, 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 $(2\sqrt{6}, 150°)$ and $(^-2\sqrt{6}, 210°)$

B $(2\sqrt{6}, 135°)$ and $(^-2\sqrt{6}, 315°)$

C $(2\sqrt{6}, 120°)$ and $(^-2\sqrt{6}, 240°)$

D $(2\sqrt{6}, 30°)$ and $(^-2\sqrt{6}, 330°)$

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 $t \geq 0$.

$$x = \tfrac{1}{3}\sqrt{t} + 3$$
$$y = 4t^2 - 7$$

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

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 $\lim_{x \to k^-} f(x)$?

A ^-2k

B $2k$

C 0

D Limit does not exist.

18 What is the value of $\lim_{x \to 3} (x^2 - 3x + 7)$?

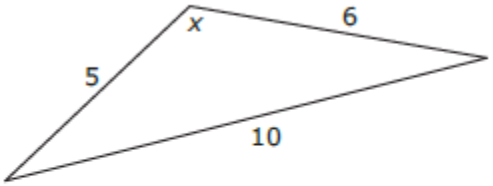
A $^-2$

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

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 $\left(3, -3\sqrt{3}\right)$

B $\left(3, 3\sqrt{3}\right)$

C $\left(-3, -3\sqrt{3}\right)$

D $\left(-3, 3\sqrt{3}\right)$

SOLUTIONS

1. D
2. A
3. C
4. D
5. D
6. B
7. B
8. B
9. A
10. A
11. B
12. C
13. D
17. B
18. B
19. D
20. A
22. C
23. C