Student Name: _Key_____
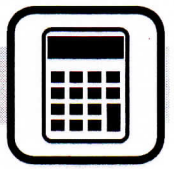
Fall 2014
NC Final Exam
Precalculus

READY

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

   (handwritten) — Graphing calculator
   — [2nd] [TRACE] [5]

3   What is the range of the function $f(x) = {}^-5 - 2(x + 3)^2$?   *(handwritten)* ✱ parabola opens down ↻ trans. down 5

   A $[{}^-5, \infty)$

   B $({}^-\infty, 5]$

   (C) $({}^-\infty, {}^-5]$

   D $({}^-\infty, \infty)$

   (handwritten) ✱yes, they used interval notation. yes, that's incorrect...
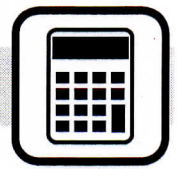
4   A wind that is blowing from the northwest toward the southeast can be represented by a vector. The vector has an eastward component and a southward component. If the eastward component has a magnitude of 5.00 miles per hour and the southward component has a magnitude of 15.00 miles per hour, in what 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 mph

E

15 mph

θ

S   5

$\tan^{-1}\left(\frac{5}{15}\right) = 18.4°$
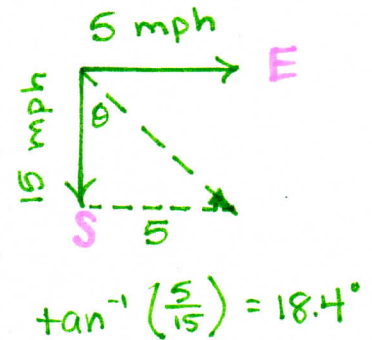
5   What value of x satisfies the equation $\log_3(x - 4) = 2$?

A   5

B   10

C   12

D   13

$x - 4 = 3^2$

$x = 9 + 4$

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

35°

28.5°

h_1

h_2

50 ft
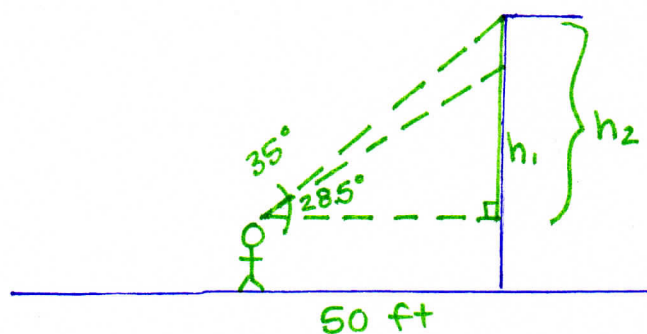
$h_1 = 27.15$

$h_2 = 35.01$

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.
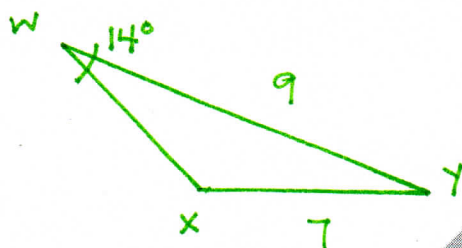- The side opposite vertex *X* has a length of 9.00 units.

ERROR?

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

A   1.73 units

Ⓑ   2.08 units

C   3.26 units

D   5.40 units

— law of sines OR law of cosines

8   Consider these two trigonometric functions:

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

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

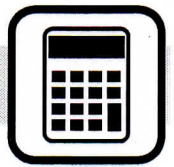How should the graph of *f* be shifted to produce the graph of *g*?

A   Shift the graph of *f* to the left $\frac{\pi}{4}$ units to produce the graph of *g*.

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

$x = y^3 - 2$

$y = \sqrt[3]{x + 2}$

11   What are the polar coordinates of the point $\left(-2\sqrt{3}, 2\sqrt{3}\right)$, where $0 \le \theta \le 360$?

A $\left(2\sqrt{6}, 150°\right)$ and $\left(-2\sqrt{6}, 210°\right)$

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

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

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

$$\left(-2\sqrt{3}\right)^2 + \left(2\sqrt{3}\right)^2 = r^2$$
$$24 = r^2$$
$$2\sqrt{6} = r$$
$$\tan^{-1}\left(\frac{2\sqrt{3}}{-2\sqrt{3}}\right) = -45° \ (=135°)$$

* Yes, they use parenthesis. Yes, that's wrong.

12   Which equation is the rectangular form of the polar equation $r = \dfrac{2}{1 + \cos\theta}$?

A $x^2 + 4y = 4$

B $x^2 + y^2 = 4$

C $y^2 + 4x = 4$

D $y^2 - 4x = 4$

$$r = \frac{2}{1 + \cos\theta}$$
$$r + r\cos\theta = 2$$
$$\sqrt{x^2 + y^2} + x = 2$$
$$x^2 + y^2 = (2-x)^2$$
$$x^2 + y^2 = 4 - 4x + x^2$$
$$y^2 + 4x = 4$$

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?

$3x - 9 = \sqrt{t}$

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

$y = 4(3x-9)^4 - 7$

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

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

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

14   The formula for a sequence is shown below.
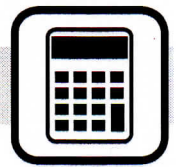
$$a_n = 2a_{n-1} + 3, \ a_1 = 3$$

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 $f(x) = \dfrac{100}{1 + 5(0.75)^x}$?

A $\lim\limits_{x \to -\infty} f(x) = 0$ and $\lim\limits_{x \to \infty} f(x) = \infty$

B $\lim\limits_{x \to -\infty} f(x) = 0$ and $\lim\limits_{x \to \infty} f(x) = 100$

C $\lim\limits_{x \to -\infty} f(x) = 1$ and $\lim\limits_{x \to \infty} f(x) = \infty$

D $\lim\limits_{x \to -\infty} f(x) = 1$ and $\lim\limits_{x \to \infty} f(x) = 100$

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

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

$$\longrightarrow \frac{(x+k)(x-k)}{x-k} = x+k$$

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

A $^{-}2k$

B   2k

C   0

D   Limit does not exist.