Key

PRECALCULUS – RELEASED ITEMS

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?

$-16t^2 + 50t = 28$

(A) 2.39 seconds

B 1.84 seconds

C 1.56 seconds

D 0.73 seconds

3 What is the range of the function $f(x) = -5 - 2(x + 3)^2$?

upside down!

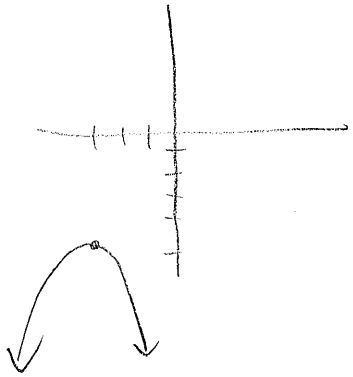
down 5 left +3

A $[-5, \infty)$

B $(-\infty, 5]$

(C) $(-\infty, -5]$

D $(-\infty, \infty)$



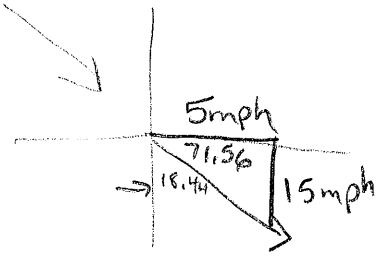
4 A wind that is blowing from the northwest toward the southeast can be represented by a vector. The vector has an eastward component and a southward component. If the eastward component has a magnitude of 5.00 miles per hour and the southward component has a magnitude of 15.00 miles per hour, in what 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.



* Be careful with direction!

5 What value of x satisfies the equation $\log_3(x-4) = 2$?

A 5

B 10

C 12

(D) 13

$3^2 = x-4$

$9 = x-4$

$13 = x$

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

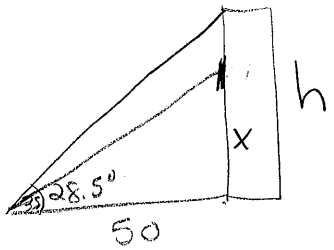
D 8.5 feet

$\tan(28.5) = \frac{x}{50}$

$x = 27.147$

$\tan(35) = \frac{h}{50}$

$h = 35.01$



Distance $= h - x = 35.01 - 27.147$

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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.

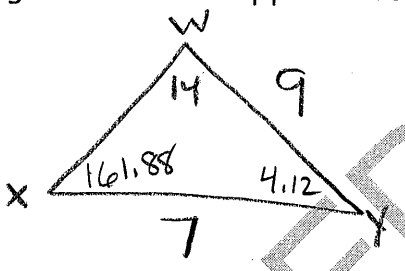
What is the ***approximate*** length of the side opposite vertex *Y*?

A 1.73 units

B 2.08 units

C 3.26 units

D 5.40 units



ASS (Ambiguous ☺)

$\frac{7}{\sin 14} = \frac{9}{\sin X} = \frac{Y}{\sin(4.12)}$

$\sin(X) = .31104$

$X = 18.12°$ or $X = 161.87$

8 Consider these two trigonometric functions:

$f(x) = 3\sin(2x) + 4$ ← No phase Shift

$g(x) = 3\sin\left(2x - \frac{\pi}{2}\right) + 4$ ← Phase Shift $\frac{(\frac{\pi}{2})}{(2)} = \frac{\pi}{2} \cdot \frac{1}{2} = \frac{\pi}{4}$

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

Exp
$y = 56(.749)^x$
100% - 75% = 25%

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

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

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

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 $(-2\sqrt{6}, 330°)$

x y

$(-2\sqrt{3})^2 + (2\sqrt{3})^2 = r^2$

$12 + 12 = r^2$

$\sqrt{24} = r$

$2\sqrt{6}$

$\tan(\theta) = \frac{2\sqrt{3}}{-2\sqrt{3}} = -1$

$\theta = 135°, 315°$

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

A ~~$x^2 + 4y = 4$~~ vertical parabola

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

C $y^2 + 4x = 4$

D $y^2 - 4x = 4$

Horizontal Parabola
Vertex (1,0)

$r + r\cos\theta = 2$

$\sqrt{x^2+y^2} + x = 2$

$\sqrt{x^2+y^2} = 2 - x$ Square both sides

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

$y^2 = 4 - 4x$

$y^2 + 4x = 4$

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

$$x = \frac{1}{3}\sqrt{t} + 3 \qquad x - 3 = \frac{1}{3}\sqrt{t} \qquad 3x - 9 = \sqrt{t}$$
$$y = 4t^2 - 7 \qquad (3x-9)^2 = t$$

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

$$y = 4\left((3x-9)^2\right)^2 - 7 = 4(3x-9)^4 - 7$$

↑ Notice → GCF

$(3x-9)(3x-9)(3x-9)(3x-9)$

Take 3 out of each!

$4 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

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.

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

3, 9, 21, 45

Which is another formula that represents the sequence?

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

~~B~~ $f(n) = 2n^3 - 3n^2 + 8n + 3$ $2(1) - 3(1) + 8(1) + 3 \neq 3$

C $f(n) = 2(n^2 + 1)$ $2(1+1) = 4$

D $f(n) = 3n^2 + 8n - 1$ $3(1) + 8(1) - 1 = 10$

$2(3)+3 = 9$

$2(9)+3 = 21$

$2(21)+3 = 45$

Use answer choices, plug in $n = 1$, see if you get 3

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

$0.8 = r$

$S = \frac{25000}{1-.8} =$

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 $\lim_{x \to -\infty} f(x) = 0$ and $\lim_{x \to \infty} f(x) = \infty$

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

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

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

Use Calculator
Use Table as $X \to \infty$

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

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

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

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

$\lim_{x \to k} (x+k) = k+k$

$= 2k$

A $-2k$

B $2k$

C 0

D Limit does not exist.

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

$(3)^2 - 3(3) + 7$

A -2

B 7

C 25

D Limit does not exist.

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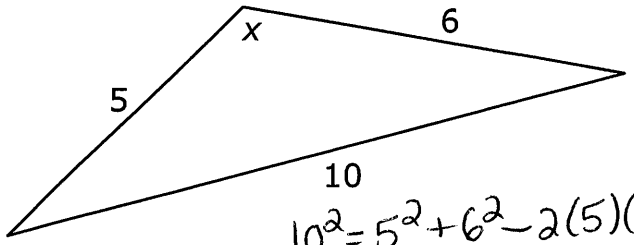
19 What is the ***approximate*** measure of angle x in the triangle below?



$10^2 = 5^2 + 6^2 - 2(5)(6)\cos(x)$

$100 = 61 - 60\cos(x)$

$39 = -60\cos(x)$

$-0.65 = \cos(x)$

$130.5^\circ = x$

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

(# of pebbles, Temperature)

$58.3 = \ln(1+x) + 52.4$

$5.9 = \ln(1+x)$

$e^{5.9} = 1 + x$

$364.04 = x$

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21 A series is shown below.

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

$r = \frac{2}{5}$ Converge

Which statement is true about the sum of the series?

$S = \frac{1}{1-(\frac{2}{5})} = \frac{5}{3}$

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.

$$x = 5\cos(t) + 3$$
$$y = 5\sin(t) - 1$$

Graph it!

Where is the center of the circle located?

A $(^{-}3, ^{-}1)$

B $(^{-}3, 1)$

(C) $(3, ^{-}1)$

D $(3, 1)$

If we worked it out...

$x-3 = 5\cos(t) \rightarrow (x-3)^2 = 25\cos^2 t$

$y+1 = 5\sin(t) \rightarrow (y+1)^2 = 25\sin^2(t)$

Add them $(x-3)^2 + (y+1)^2 = 25\cos^2 t + 25\sin^2 t$

$(x-3)^2 + (y+1)^2 = 25(\cos^2 t + \sin^2 t)$ ← Pythagorean Identity

$(x-3)^2 + (y+1)^2 = 25$

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$r\ \theta$

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

$x = 6\cos\left(\frac{4\pi}{3}\right) = 6\left(-\frac{1}{2}\right) = -3$

$y = 6\sin\left(\frac{4\pi}{3}\right) = 6\left(-\frac{\sqrt{3}}{2}\right) = -3\sqrt{3}$

A $(3, -3\sqrt{3})$

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

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

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

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