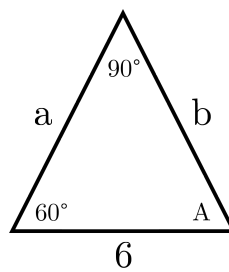


Name: _____
School: _____
Compliments of my sister

Pre-Calculus Individual 2019

Benjamin Franklin Tournament

1. Given $f(x) = 3x^2 - 15x + 3$ and $g(x) = x^2 + 20$, find $g(f(2))$.
2. Given $\frac{x^2-x-2}{x-2}$, find **all** asymptotes (vertical, horizontal, oblique).
3. Given $\log_3 \frac{9^x}{243^y} = 1$ and $\log_2 \frac{32^y}{16^x} = 7$. Find $2x + y + 10$.
4. $f(x) = \frac{3x^2+7x-8}{\sqrt{x^3+6x-11}}$. Find $f(2)$.
5. Find the center and radius: $x^2 + y^2 - 6x - 6y + 38 = 64$.
6. Given $\tan(\theta) = \frac{20}{21}$, $\frac{x}{29} = \cos(\theta)$, $\frac{y}{29} = \sin(\theta)$, and that x and y are both positive integers, what is $2x + 4y$?
7. Jonathan the Cat runs a business selling packs of catnip for \$0.50, packs of nutritional yeast for \$0.25 to neighborhood cats. He sells 14 packs total and makes \$4.50. How many packs of nutritional yeast did he sell?
8. $f(x) = 4x^2 + 2x + 1$, $g(x) = 5x$. Find $f(3) - g(4) + f(g(1))$.
9. Given the following triangle, what is $2a - 8$?



Note: Figure not drawn to scale.

10. Solve for $[0 \leq \theta < 360]$.

$$\tan^2 \theta - 1 = -2 \tan^2 \theta$$

11. Find the average rate of change of $g(x) = x^2$ over the interval $[-6, 3]$.

12. Simplify: $\cos(-4\theta) \cos(-2\theta) - \sin(-4\theta) \sin(-2\theta)$

13. Divide $\frac{4x^2-19}{x+2}$. Write your answer in fraction form.

14. In an experiment, the probability that event A occurs is $3/8$ and the probability that event B occurs is $5/7$. If A and B are independent events, what is the probability that A and B both occur?

15. Bruce throws a basketball launched at a velocity of 20 m/s in a direction making an angle of 60° upward with the horizontal. What is the maximum height reached by the basketball? (It follows parabolic trajectory). The equation for a projectile is

$$x = x_0 + v_0 t + \frac{1}{2} a t^2, \quad a = -10, \quad v = at$$

Answers

1. 245
2. no asymptotes
3. $\frac{1}{5}$
4. 6
5. center: $(3, 3)$
radius: $2\sqrt{11}$
6. 122
7. 10
8. 134
9. -2
10. $\theta = \frac{\pi}{6}, \frac{7\pi}{6}, \frac{5\pi}{6}, \frac{11\pi}{6}$
11. -3
12. $\cos 6\theta$
13. $4x - 8 - \frac{3}{x+2}$
14. $\frac{15}{56}$
15. 15 meters