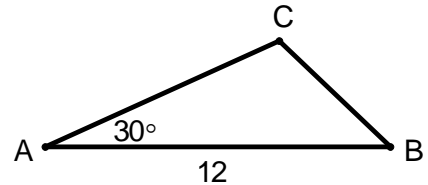


1. Find the value of the following limit: $\lim_{x \rightarrow 5} (2^{(9-x)})$.
2. A sequence is defined recursively by $a_{(n+1)} = 3a_n - 5$ for all integers $n \geq 1$. If $a_{10} = 16$, find the value of a_8 .
3. Let \vec{a} and \vec{b} represent vectors such that $\vec{a} = (3, 2)$ and $\vec{b} = (-8, 13)$. Find the **ordered pair** that represents $3\vec{a} + 5\vec{b}$.
4. Find the value of the indicated sum: $\sum_2^5 (k^3 + 3.782)$. Express your answer as an **exact decimal**.
5. Find the tenth term of the geometric sequence whose first three terms are respectively: $\frac{1024}{5}$, $\frac{512}{15}$, and $\frac{256}{45}$. Express your answer as a common fraction reduced to lowest terms.
6. Given the relation defined by $f = \{(2, 7), (5, 3), (7, 11), (19, w)\}$. Find the product of all the distinct real values of w for which f^{-1} is **not** a function.
7. Let k be a positive integer and let w be an integer such that two of the roots for x of the cubic equation $x^3 - 17x^2 + kx + w = 0$ are consecutive positive integers. Find the value of k if $|k - w|$ is a maximum.

8. The angle of elevation of the summit from the base of a ski lift is 35° . If a skier rides 1000 feet on this lift to the summit, find the number of feet in the **vertical distance** between the base of the lift and the summit. Express your answer as a **decimal** rounded to the nearest tenth of a foot.

9. In the diagram, $\angle CAB = 30^\circ$, and $AB = 12$. $AC = k\sqrt{3}$, and $BC = w$ where k and w are positive integers, and $w < 164$. Find the sum of all possible distinct values of w .



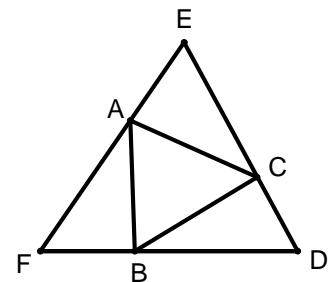
10. If $A = \begin{bmatrix} 2 & 3 \\ 1 & -3 \end{bmatrix} \cdot \begin{bmatrix} 5 & 4 \\ 1 & 7 \end{bmatrix}$, find the value of $\det(A)$.

11. If $(3x - 4y + z + 2a)^2$ is expanded and completely simplified, find the sum of the numerical coefficients.

12. Let x be an integer such that $0 < x < 150$. Find the sum of all possible distinct values of x such that all three of the following conditions hold: $\tan(3x + 17)^\circ < 0$, $\sin(5x - 13)^\circ > 0$, and $\cos(2x + 3)^\circ < 0$.

13. The area of the ellipse $\frac{(x-3)^2}{36} + \frac{(y+2)^2}{k} = 1$ is 18 times the area of the circle $x^2 + y^2 = 4$. Find the value of k .

14. In the diagram, $\triangle DEF$ is equilateral, points A , B , and C lie on \overline{EF} , \overline{DF} , and \overline{DE} respectively. $\overline{EA} \cong \overline{FB} \cong \overline{DC}$. The ratio of the area of $\triangle ABC$ to the area of $\triangle DEF$ is 53:128. If $EF = 256$, and $AE < AF$, find AF . Express your answer as a decimal rounded to the nearest tenth.



15. Given that $\sin(A) = \frac{2}{5}$ and $\frac{\pi}{2} < A < \pi$ (where A is measured in radians). Then $\sin(2A)$ can be expressed in simplest radical form as $\frac{k\sqrt{w}}{p}$ where k and p are relatively prime integers and $p > 0$. Find the value of $(k + w + p)$.
16. From a group of 8 men and 7 women, a committee of 3 is selected at random. Find the probability that the committee consists of 2 members of one sex and 1 member of the opposite sex.
17. If $\sin(x) = \frac{5}{13}$ and $\cot(y) = -\frac{3}{4}$, then there are two possible answers for $\tan(x - y)$. Find the sum of these two possible distinct answers. Express your answer as an improper fraction reduced to lowest terms.
18. Let $C(n, k) = \frac{n!}{k!(n-k)!}$ where n and k represent positive integers. Find the **sum** of all distinct values of n such that $97 < C(n, 6) < 2114$.
19. The graph of the rational function $g(x) = \frac{x^2 - 5x + 6}{x - 4}$ has a slant (oblique) asymptote which can be expressed in the form: $f(x) = mx + b$. Find the value of $(m + b)$.
20. Let x and n represent two digit positive **odd** integers for which the tens digit is non-zero and for which $n > x$. Find the largest possible value for x for which the sum of the consecutive positive **odd** integers from 1 through x is 99 less than the sum of the consecutive positive **odd** integers from x through n .

2011 RAA

Name ANSWERS

Pre-Calculus

School _____

(Use full school name – no abbreviations)

____ Correct X 2 pts. ea. =

Note: All answers must be written legibly in simplest form, according to the specifications stated in the Contest Manual. Exact answers are to be given unless otherwise specified in the question. No units of measurement are required.

1. 16

11. 4

2. 4

12. 2535

3. (-31, 71)

(Must be this ordered pair.)

13. 144

4. 239.128

(Must be this exact decimal.)

14. 187.9

(Must be this decimal.)

5. $\frac{2}{98415}$

(Must be this reduced common fraction.)

15. 42

6. 231

16. 0.8 OR .8 OR $\frac{4}{5}$

7. 26

17. $\frac{507}{112}$

(Must be this reduced improper fraction.)

8. 573.6

(Must be this decimal, feet optional.)

18. 46

9. 216

19. 0 OR "zero"

10. -279

20. 43