School:_____ Team:_____

Team Members: 1._____ 2._____

3._____ 4._____ 5._____

Instructions: Label your answers with appropriate units.
Do not round or approximate answers.
Write your answers on the lines provided.

1. What is the last digit of $(7^3)^5$?

Ans:_____

2. Solve $1+\frac{x-1}{x-3}>\frac{x-2}{x-1}$. Write your answer using interval notation.

Ans:_____

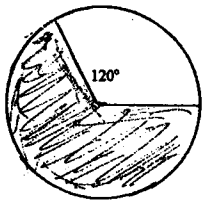
3. Solve $\cos(2x) - \cos^2(2x) + \cos^3(2x) - \ldots = \frac{1}{3}$, where $0 \le x < 2\pi$.

Ans:_____

4. Let $f(x)=kx^2+kx+k$. Find all values of k such that $f'(k)=1$.

Ans:_____

5. The area of the shaded part of the circle is 24π square inches. Find the radius of the circle.



Ans:_____

School:_____ Team:_____

Team Members: 1._____ 2._____

3._____ 4._____ 5._____

Instructions: Label your answers with appropriate units.
Do not round or approximate answers.
Write your answers on the lines provided.

1. Evaluate $\frac{d}{dx}\int_x^{-1}\ln\left(t^2+1\right)dt$.

Ans:_____

2. If the lengths of the base and height of a triangle are increased by 50% each, by what percent did the area of the triangle increase?

Ans:_____

3. How many two element subsets of the set {1, 2, 3,..., 15} have an even number as the sum of their elements?

Ans:_____

4. Find the value of the constant term in the expansion of $\left(x^2-\frac{1}{x}\right)^6$.

Ans:_____

5. Two teams working together can complete a certain job in 6 days. The first team working alone can complete 40% of the job in two more days than the second team working alone can complete 13⅓% of the job. How much time does the slower team need to complete the entire job working alone?

Ans:_____

School:_____ Team:_____

Team Members: 1._____ 2._____

3._____ 4._____ 5._____

Instructions: Label your answers with appropriate units.
Do not round or approximate answers.
Write your answers on the lines provided.

1. A particle with initial velocity $0\,m/s$ moves at constant acceleration of $15\,m/s^2$. Find the distance traveled by the particle in the first 10 seconds.

Ans:_____

2. A rectangular box has a square base, and the sum of the lengths of all edges of the box is 100 m. What must the height of the box be in order to maximize the surface area of the box?

Ans:_____

3. The sum of n consecutive integers is 400 less than the sum of the next n consecutive integers. Find n.

Ans:_____

4. How many liters of 2.5% acid solution must be mixed with 5.5% acid solution to obtain 150 liters of 3.2% acid solution?

Ans:_____

5. Evaluate the determinant $\begin{vmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{vmatrix}$.

Ans:_____

School:_____ Team:_____

Team Members: 1._____ 2._____

3._____ 4._____ 5._____

Instructions: Label your answers with appropriate units.
Do not round or approximate answers.
Write your answers on the lines provided.

1. Solve $\begin{cases} \log_2(x+y)-\log_2(x-y)=1 \\ x^2-y^2=2 \end{cases}$

Ans:_____

2. Let $a>b>0$. Evaluate the limit $\lim_{x\to 0}\frac{e^{ax}-1}{e^{bx}-1}$.

Ans:_____

3. Find the area of the circle inscribed in an equilateral triangle of side length 6 cm.

Ans:_____

4. Evaluate the sum: $\sin(0^\circ) + \sin(3^\circ) + \sin(6^\circ) + \ldots + \sin(360^\circ)$.

Ans:_____

5. A courier drives to his destination at 60 mph, then immediately retraces his path at 40 mph. What was his average speed for this trip?

Ans:_____

School:_____ Team:_____

Team Members: 1._____ 2._____

3._____ 4._____ 5._____

Instructions: Label your answers with appropriate units.
Do not round or approximate answers.
Write your answers on the lines provided.

1. Solve $3^{2x-1} + 3^{x+1} = 12$.

Ans:_____

2. Solve $4^{\sin x \cos x} - \sqrt{2} = 0$ where $0 \leq x < 2\pi$.

Ans:_____

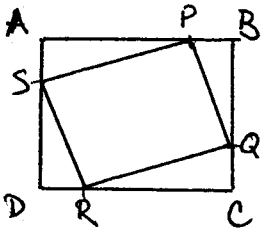
3. Evaluate the integral $\int_{-k}^{k} \sqrt{k^2 - x^2}\,dx$.

Ans:_____

4. Which number in the following list is the largest: $2^3 \cdot 11^{15}$, $6^{16} \cdot 16^4$, 9^{16}, 72^9?

Ans:_____

5. Square PQRS is inscribed in square ABCD (see figure) so that |AP| : |PB| = 4 : 1. If the area of square ABCD is 400 sq in, what is the area of square PQRS?



Ans:_____