Round 0

1. 105
2. $\frac{5}{2}\sqrt{6}$
3. $8\sqrt{3}$
4. 9

Round 1

1. 34
2. 13
3. 8
4. $\frac{1}{8}$

Round 2

1. $\frac{\sqrt{73}}{8}$
2. 8
3. 32
4. $\frac{1}{3}$

Round 3

1. 2
2. -5.5 or $-\frac{11}{2}$ or $-5\frac{1}{2}$
3. 7
4. 10

Round 4

1. $\frac{3\pi}{2}$
2. $\frac{19}{13}$
3. 0.4 or $\frac{2}{5}$
4. $\frac{4}{9}$

Round 5

1. 51
2. $\sqrt{157}$
3. $\frac{\pi}{6}$
4. $\frac{-80}{27}$

Round 6

1. 700%
2. 13
3. 12
4. 140

Round 7

1. 6
2. 16
3. $\frac{1}{3}$
4. 26

Round 8

1. $7\sqrt{3}$
2. 1.96
3. 33
4. $\frac{2\pi}{3}, \frac{4\pi}{3}, 0$

Round 9

1. $\frac{\sqrt{2\pi}}{2}$
2. 8
3. 5
4. $\frac{C(26,5)}{C(52,5)}$

Round 10

1. 5
2. 88
3. $19 + i^{-19}$
4. $10\sqrt{23}$

Round 0

1. 105
$$\frac{|60h-11m|}{2}=\frac{60\bullet 9-11\bullet 30}{2}=105$$
2. $2.5\sqrt{6}$
$$Area = 0.5ab\sin C = .5(10)(\sqrt{2})\frac{\sqrt{3}}{2} = 2.5\sqrt{6}$$
3. $8\sqrt{3}$ - Definition of a derivative
$\frac{d}{dx}\left[\tan^2 x\right]=2\tan x\sec^2 x$. Plug in x = $\pi/3$.
$2\bullet\sqrt{3}\bullet 2^2=8\sqrt{3}$
4. 9 2^{17} ends in a 2 so xxx2 -3 would end in a 9.

Round 1

1. 34 - $\frac{6-0}{2\bullet 3}[1+2\bullet 4+2\bullet 7+11]$=34
2. 13 Add 1st column to 3rd column gives $\begin{vmatrix}1 & 2 & 0\\ 2 & -1 & 6\\ 5 & -3 & 13\end{vmatrix}$. Expanding by minors of the first row
$$1\begin{vmatrix}-1 & 6\\ -3 & 13\end{vmatrix}-2\begin{vmatrix}2 & 6\\ 5 & 13\end{vmatrix}$$
$1(-13+18)-2(26-30)=5+8=13.$

3. 8 Reorder: 1,2,5,6,8,10,12. Median = 6 , Q1 = 2, Q3 = 10. 10-2=8

4. $\frac{1}{8}$

$$\frac{1+2+3+4+5}{5!}=\frac{15}{5!}=\frac{\cancel{15}}{\cancel{5}\bullet 4\bullet \cancel{3}\bullet 2\bullet 1}=\frac{1}{8}.$$

Round 2

1. $\frac{\sqrt{73}}{8}$

$$\frac{(x-2)^2}{16}-\frac{(y+1)^2}{\frac{9}{4}}=1$$
$$a=4, b=\frac{3}{2}, c^2=a^2+b^2$$
$$c=\frac{\sqrt{73}}{2}, e=\frac{c}{a}$$
$$\frac{\frac{\sqrt{73}}{2}}{4}=\frac{\sqrt{73}}{8}$$

2. 8 2,5,6; 2,4,7; 2,3,8; 3,4,6; 4,1,8; 1,3,9; 1,5,7; 1,2,10

3. 32 The radius of the circle is 8. The area of the triangle is ½ the product of the legs, 32.

4. $\frac{1}{3}$ $\frac{1}{2}=\frac{2x+1}{x+3}; x=\frac{1}{3}$

Round 3

1. 2 Find the vertex and take the y coordinate. Completing the square gives
$$\left(x^2-2x+1\right)+3-1.$$

2. -5.5 $\frac{84-150}{12}=-5.5$
3. 7 - Differentiability implies that the function must be continuous so the both the values and the slopes must be the same for x = 2. Plugging x = 2 into both pieces and setting them equal gives us $4a+b=24-2b$ and plugging into the derivatives gives us $4a=12$. Solving the system gives us $a=3$ and $b=4$. $a+b=3+4=7$

4. 10

quarters	dimes	Nickels
1	1	3
1	2	1
1	0	5
2	0	0
0	5	0
0	0	10
0	1	8
0	2	6
0	3	4
0	4	2

Round 4

1. $\frac{3\pi}{2}$

$\sin^2 x - \sin x - 2 = 0; (\sin x - 2)(\sin x + 1) = 0; \sin x = 2,$

$\sin x \neq 2; \sin x = -1; \left(\frac{3\pi}{2}, -1\right)$

2. $\frac{19}{13}$ Clearing parentheses gives $2x - 3ix + 2yi + 3y = 4 + i$. Using the real parts and the imaginary parts gives the two equations : $2x + 3y = 4, -3x + 2y = 1$. Solving this system gives

$$y = \frac{14}{13}, x = \frac{5}{13}.$$

3. 0.4 or $\frac{2}{5}$

$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{.2}{x} = 0.5$

$P(B) = 0.4$

4. $\frac{4}{9}$ Solving for y when x =1 we find that y =1. Differentiating implicitly gives us $8xy + 4x^2 \frac{dy}{dx} + 1 = 0$.

$\rightarrow \frac{dy}{dx} = \frac{-(1+8xy)}{4x^2}$ Plugging in $(1,1)$ gives us $\frac{dy}{dx} = -\frac{9}{4} \therefore m_{normal} = \frac{4}{9}$

Round 5

1. 51 $\frac{2}{5} = \frac{x}{y}, x + y = 119$. Solving this system gives $x = 34, y = 85$. The absolute value of the difference is 51.

2. $\sqrt{157}$ Let the length $= 2w - 1$ where w is the width. The perimeter is 34 so we have

$4w - 2 + 2w = 34, w = 6, l = 11$. The diagonal would form a right triangle with legs of 6 and 11. Diagonal would be $\sqrt{121 + 36} = \sqrt{157}$.

3. $\frac{\pi}{6}$

$$3x^2 - 2\sqrt{3}xy + 5y^2 - 10x + 5y - 9 = 0$$
$$\tan 2\theta = \frac{B}{A - C}$$
$$\tan 2\theta = \frac{-2\sqrt{3}}{3-5} = \frac{-2\sqrt{3}}{-2} = \sqrt{3}$$
$$2\theta = \frac{\pi}{3}, \theta = \frac{\pi}{6}$$

4. $f(x + \Delta x) = f(x) + f'(x)\Delta x$

$\rightarrow f(-26) = f(-27) + f'(-27)(1) =$

$= -3 + \frac{1}{3(-27)^{2/3}} \cdot 1 = -3 + \frac{1}{27} = \frac{-80}{27}$

Round 6

1. 700% Let the original edge be 1 which would have a volume of 1. Let the edge of the new cube be 2 which is an increase of 100%. The new volume would be 8 which is an increase of 700%.

1. 13 Find the area of $y = \cos x$ between $0 \le x \le \frac{\pi}{2}$:

$\int_0^{\pi/2} \cos x = 1$. There are 13 of these regions bounded by the axis and $y = \cos x$.

3. 12

$$r=\frac{12}{1-\sin\theta}$$
$$e=1, ep=12, p=12$$
12

4. 140
$$\left(x+y\right)^2=x^2+2xy+y^2$$
$$25=x^2+y^2-2; 27=x^2+y^2$$

$$x^3+y^3=\left(x+y\right)\left(x^2-xy+y^2\right)$$
$$x^3+y^3=5\left(27+1\right)$$
which is 140.

Round 7

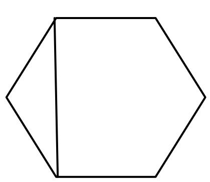
1. 6 1,3;1,8;2,7;3,6;4,5;7,9

2. 16
$$1-i=(\sqrt{2},\frac{-\pi}{4})=\sqrt{2}cis\frac{-\pi}{4}$$
$$(1-i)^8=\left(\sqrt{2}\right)^8 cis8\left(\frac{-\pi}{4}\right)=16cis(-2\pi)$$
$$=16$$

3. $\frac{1}{3}$
$$\lim_{n\to\infty}\sum_{i=1}^{n}\frac{i^2}{n^3}=\lim_{n\to\infty}\sum_{i=1}^{n}\left(\frac{i}{n}\right)^2\bullet\frac{1}{n}=$$
$$\int_0^1 x^2dx=\frac{x^3}{3}\Big|_0^1=\frac{1}{3}$$

4. 26 To get the minimum perimeter, the 12 must correspond with the 6. The perimeter of the smaller is 13 so $\frac{6}{13}=\frac{12}{x}; x=26$.

Round 8



1. $7\sqrt{3}$
Shown is the shortest diagonal. The vertex angle of this triangle is 120 and drawing the altitude of the triangle

makes 2 30-60-90 triangles. Since the hypotenuse is 7, the side opposite the 60, which would be ½ the diagonal is $\frac{7}{2}\sqrt{3}$. Double this makes the diagonal $7\sqrt{3}$.

2. 1.96 By the empirical rule, 95% of the area under the normal density curve falls standard deviations 1.96.

3. 33 The first inequality has the solution $x\le 18$. The 2nd has the solution $10\sqrt{2}\le x\le 20$. The 3rd has solution $15<x\le 17$. The whole numbers that satisfy all these are 17 and 16 which have a sum of 33.

4. $\frac{2\pi}{3},\frac{4\pi}{3},0$
$$\cos(2x)-\cos(x)=0$$
$$2\cos^2 x-1-\cos(x)=0$$
$$\left(2\cos x+1\right)\left(\cos x-1\right)=0$$
$$\cos(x)=\frac{-1}{2},1$$
$$x=\frac{2\pi}{3},\frac{4\pi}{3},0$$

Round 9

1. $\frac{\sqrt{2\pi}}{2}$ 2nd Fundamental Theorem:

$$F(x)=\int_0^{x^2}\sin t dt,\ F'\left(x\right)=2x\sin\left(x^2\right)$$

$$F'\left(\frac{\sqrt{\pi}}{2}\right)=$$

$$2\bullet\frac{\sqrt{\pi}}{2}\sin\left(\left(\frac{\sqrt{\pi}}{2}\right)^2\right)=2\cdot\frac{\sqrt{\pi}}{2}\cdot\frac{\sqrt{2}}{2}=\frac{\sqrt{2\pi}}{2}$$

2. 8

$10x^2+31x+15-(38x+27)=10x^2-7x-12$ which factors as $(2x-3)(5x+4)$. The sum of $2-3+5+4=8$.

3. 5

$\log_2(\log_x 25)=1; 2=\log_x 25; x^2=25; x=5$

4. $\frac{C(26,5)}{C(52,5)}$ You chose 5 reds from the 26. The total ways to pick a hand is 52 pick 5.

Round 10

1. 5

$$\frac{5x+6}{x^2-7x+12}=\frac{A}{x-3}+\frac{B}{x-4}$$
$$A(x-4)+B(x-3)=5x+6$$
$$A+B=5$$
$$-4A-3B=6$$
$$A=-21, B=26$$

2. 88 The common difference is 3. Then we need to find the number of terms.

$23=-7+3(n-1); n=11.$ To find the sum $\frac{n}{2}(a_1+a_n)=\frac{11}{2}(-7+23)=88$

3. $19+i^{-19}$, 4th one, last one

4. $10\sqrt{23}$ The surface area – the lateral area gives the area of the base which is 4π.

This makes the radius of the circular base 2. Next, the slant height must be found so the altitude of the cone can be found using Pythag.

$96\pi=\pi lr; 96\pi=\pi 2l; l=48$. So using a right triangle with one leg 2 and the hypotenuse 48 gives an altitude of $10\sqrt{23}$.