

**#1 Trigonometry - Hustle**  
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Evaluate:  $\sin^2 12^\circ + \sin^2 40^\circ + \sin^2 50^\circ + \sin^2 78^\circ$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#1 Trigonometry - Hustle**  
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Evaluate:  $\sin^2 12^\circ + \sin^2 40^\circ + \sin^2 50^\circ + \sin^2 78^\circ$

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Round 1 2 3 4 5

**#1 Trigonometry - Hustle**  
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Round 1 2 3 4 5

**#1 Trigonometry - Hustle**  
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Evaluate:  $\sin^2 12^\circ + \sin^2 40^\circ + \sin^2 50^\circ + \sin^2 78^\circ$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#2 Trigonometry - Hustle**  
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In  $\triangle ABC$ ,  $a=4$ ,  $b=6$ , and  $\angle C=120^\circ$ . Find the length of the altitude to the longest side of the triangle.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#2 Trigonometry - Hustle**  
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---

In  $\triangle ABC$ ,  $a=4$ ,  $b=6$ , and  $\angle C=120^\circ$ . Find the length of the altitude to the longest side of the triangle.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#2 Trigonometry - Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#2 Trigonometry - Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#3 Trigonometry - Hustle**  
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Evaluate:  $\cos\left(2\cos^{-1}\left(\frac{4}{5}\right)\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#3 Trigonometry - Hustle**  
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---

Evaluate:  $\cos\left(2\cos^{-1}\left(\frac{4}{5}\right)\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#3 Trigonometry - Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#3 Trigonometry - Hustle**  
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---

Evaluate:  $\cos\left(2\cos^{-1}\left(\frac{4}{5}\right)\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#4 Trigonometry - Hustle**  
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Find the value of  $|\cos(x - y)|$ , given that

$$\sin x = \frac{5}{13}, \cos y = -\frac{3}{5}, 0 < x < \frac{\pi}{2}, \text{ and}$$

$$\pi < y < \frac{3\pi}{2}.$$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#4 Trigonometry - Hustle**  
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---

Find the value of  $|\cos(x - y)|$ , given that

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Round 1 2 3 4 5

**#4 Trigonometry - Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#4 Trigonometry - Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#5 Trigonometry - Hustle**  
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How many times will the graph of

$f(x) = 5\cos\left(\frac{x}{2}\right) + 1$  intersect the  $x$ -axis on the interval  $[-2\pi, 2\pi]$ ?

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#5 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

---

How many times will the graph of

$f(x) = 5\cos\left(\frac{x}{2}\right) + 1$  intersect the  $x$ -axis on the interval  $[-2\pi, 2\pi]$ ?

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#5 Trigonometry - Hustle**  
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---

How many times will the graph of

$f(x) = 5\cos\left(\frac{x}{2}\right) + 1$  intersect the  $x$ -axis on the interval  $[-2\pi, 2\pi]$ ?

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#5 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

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How many times will the graph of

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#6 Trigonometry - Hustle**  
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If  $\sin x + \cos x = A \sin(x + B)$  for all real  $x$ ,  
where  $A$  and  $B$  are real numbers,  $A > 0$ , and  
 $B > 0$ , find the minimum value of the product  
 $AB$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#6 Trigonometry - Hustle**  
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---

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#7 Trigonometry - Hustle**  
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---

The minute and hour hands of a clock are perpendicular to each other twice between 5 pm and 6 pm. Compute the elapsed amount of time, in minutes and seconds, between these two times, correct to the nearest second.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#7 Trigonometry - Hustle**  
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Round 1 2 3 4 5

**#8 Trigonometry - Hustle**  
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In  $\triangle ABC$ , where  $A$  and  $B$  are acute angles,  
 $3\sin A + 4\cos B = 6$  and  $4\sin B + 3\cos A = 1$ .  
Find the measure of  $\angle C$ , in radians.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#8 Trigonometry - Hustle**  
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**#8 Trigonometry - Hustle**  
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Find the measure of  $\angle C$ , in radians.

Answer : \_\_\_\_\_

Round 1 2 3 4 5



**#9 Trigonometry – Hustle**  
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The depth  $d$  of water, in feet, at a point near the shore varies due to the tides. A particular equation relating  $d$  to time  $t$ , in hours after midnight on a given day, is

$$d = 3 + 2\cos\left(\frac{\pi}{5.4}(t - 4)\right).$$
 Find the first positive

time  $t$  at which the water is exactly 4 feet deep.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#9 Trigonometry – Hustle**  
**MA $\odot$  National Convention 2011**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#10 Trigonometry - Hustle**  
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Find the smallest positive radian solution to the equation  $5\cos x - 2\cos^2 x = 2$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#10 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Find the smallest positive radian solution to the equation  $5\cos x - 2\cos^2 x = 2$ .

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Round 1 2 3 4 5

**#10 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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Round 1 2 3 4 5

**#10 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Find the smallest positive radian solution to the equation  $5\cos x - 2\cos^2 x = 2$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#11 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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If  $\tan(x+y)=33$  and  $\tan x=3$ , find the value of  $\tan y$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#11 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

If  $\tan(x+y)=33$  and  $\tan x=3$ , find the value of  $\tan y$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#11 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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**MA@ National Convention 2011**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#12 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\frac{\cos 87^\circ}{\sin 1^\circ} - \frac{\sin 87^\circ}{\cos 1^\circ}$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#12 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\frac{\cos 87^\circ}{\sin 1^\circ} - \frac{\sin 87^\circ}{\cos 1^\circ}$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#12 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\frac{\cos 87^\circ}{\sin 1^\circ} - \frac{\sin 87^\circ}{\cos 1^\circ}$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#12 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\frac{\cos 87^\circ}{\sin 1^\circ} - \frac{\sin 87^\circ}{\cos 1^\circ}$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#13 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\prod_{i=1}^{89} \tan i^\circ$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#13 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\prod_{i=1}^{89} \tan i^\circ$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#13 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\prod_{i=1}^{89} \tan i^\circ$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#13 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\prod_{i=1}^{89} \tan i^\circ$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#14 Trigonometry - Hustle**  
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---

If the sum of the radian solutions to the equation  $\sin^2 x - \sin x = \cos^2 x$  on the interval  $[0, 2\pi]$  is expressed as  $\frac{a\pi}{b}$ , where  $a$  and  $b$  are relatively prime positive integers, find the product  $ab$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#14 Trigonometry - Hustle**  
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---

If the sum of the radian solutions to the equation  $\sin^2 x - \sin x = \cos^2 x$  on the interval  $[0, 2\pi]$  is expressed as  $\frac{a\pi}{b}$ , where  $a$  and  $b$  are relatively prime positive integers, find the product  $ab$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#14 Trigonometry - Hustle**  
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Round 1 2 3 4 5

**#14 Trigonometry - Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#15 Trigonometry - Hustle**  
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Evaluate:  $\cos\left(\frac{4\pi}{3} - \cos^{-1}\left(-\frac{1}{2}\right)\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#15 Trigonometry - Hustle**  
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---

Evaluate:  $\cos\left(\frac{4\pi}{3} - \cos^{-1}\left(-\frac{1}{2}\right)\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#15 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#15 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\cos\left(\frac{4\pi}{3} - \cos^{-1}\left(-\frac{1}{2}\right)\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#16 Trigonometry - Hustle**  
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If  $f(x) = -5\sin\left(7x + \frac{\pi}{3}\right) + 4$ , find the smallest positive value  $c$  such that  $f(c)$  has maximum value.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#16 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

If  $f(x) = -5\sin\left(7x + \frac{\pi}{3}\right) + 4$ , find the smallest positive value  $c$  such that  $f(c)$  has maximum value.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#16 Trigonometry - Hustle**  
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If  $f(x) = -5\sin\left(7x + \frac{\pi}{3}\right) + 4$ , find the smallest positive value  $c$  such that  $f(c)$  has maximum value.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#16 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5



**#17 Trigonometry - Hustle**  
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---

Find the radian measure of the acute angle between the vectors  $\langle 1,3 \rangle$  and  $\langle -2,4 \rangle$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#17 Trigonometry - Hustle**  
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---

Find the radian measure of the acute angle between the vectors  $\langle 1,3 \rangle$  and  $\langle -2,4 \rangle$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#17 Trigonometry - Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#17 Trigonometry - Hustle**  
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---

Find the radian measure of the acute angle between the vectors  $\langle 1,3 \rangle$  and  $\langle -2,4 \rangle$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#18 Trigonometry - Hustle**  
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Suppose  $\frac{\sin \frac{\pi}{10}}{z} = \frac{\sin \frac{\pi}{20}}{10}$ . If  $z = A \cos\left(\frac{\pi}{20}\right)$ ,  
where  $A$  is a real number, find the value of  $A$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#18 Trigonometry - Hustle**  
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---

Suppose  $\frac{\sin \frac{\pi}{10}}{z} = \frac{\sin \frac{\pi}{20}}{10}$ . If  $z = A \cos\left(\frac{\pi}{20}\right)$ ,  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#18 Trigonometry - Hustle**  
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where  $A$  is a real number, find the value of  $A$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#19 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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Evaluate:  $\cot\left(-\frac{4\pi}{3}\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#19 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\cot\left(-\frac{4\pi}{3}\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#19 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\cot\left(-\frac{4\pi}{3}\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#19 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Evaluate:  $\cot\left(-\frac{4\pi}{3}\right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#20 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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If  $\left(2\left(\cos\frac{5\pi}{6} + i\sin\frac{5\pi}{6}\right)\right)^4 = a + bi$ , where  $a$  and  $b$  are real numbers and  $i = \sqrt{-1}$ , find  $a + b$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#20 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

If  $\left(2\left(\cos\frac{5\pi}{6} + i\sin\frac{5\pi}{6}\right)\right)^4 = a + bi$ , where  $a$  and  $b$  are real numbers and  $i = \sqrt{-1}$ , find  $a + b$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#20 Trigonometry - Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#20 Trigonometry - Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#21 Trigonometry - Hustle**  
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A point  $(x, y)$  lies in the first quadrant on the circle with equation  $x^2 + y^2 = 1$ . A ray from the origin through  $(x, y)$  makes an acute angle  $\theta$  with the positive  $x$ -axis. Find the value of  $\tan \theta$  if  $\theta = \cos^{-1}\left(\frac{4x+3y}{5}\right)$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#21 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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A point  $(x, y)$  lies in the first quadrant on the circle with equation  $x^2 + y^2 = 1$ . A ray from the origin through  $(x, y)$  makes an acute angle  $\theta$  with the positive  $x$ -axis. Find the value of  $\tan \theta$  if  $\theta = \cos^{-1}\left(\frac{4x+3y}{5}\right)$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#21 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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A point  $(x, y)$  lies in the first quadrant on the circle with equation  $x^2 + y^2 = 1$ . A ray from the origin through  $(x, y)$  makes an acute angle  $\theta$  with the positive  $x$ -axis. Find the value of  $\tan \theta$  if  $\theta = \cos^{-1}\left(\frac{4x+3y}{5}\right)$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#21 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

A point  $(x, y)$  lies in the first quadrant on the circle with equation  $x^2 + y^2 = 1$ . A ray from the origin through  $(x, y)$  makes an acute angle  $\theta$  with the positive  $x$ -axis. Find the value of  $\tan \theta$  if  $\theta = \cos^{-1}\left(\frac{4x+3y}{5}\right)$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#22 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

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In  $\triangle ABC$ ,  $\angle A = 30^\circ$  and  $b = 10$ . Find the value of  $a \sin B$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#22 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

---

In  $\triangle ABC$ ,  $\angle A = 30^\circ$  and  $b = 10$ . Find the value of  $a \sin B$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#22 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

---

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#22 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

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In  $\triangle ABC$ ,  $\angle A = 30^\circ$  and  $b = 10$ . Find the value of  $a \sin B$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#23 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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What is the maximum value of  $r$  in the equation  $r = 7 - 6\cos(7\theta)$ ?

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#23 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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What is the maximum value of  $r$  in the equation  $r = 7 - 6\cos(7\theta)$ ?

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#23 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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What is the maximum value of  $r$  in the equation  $r = 7 - 6\cos(7\theta)$ ?

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#23 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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What is the maximum value of  $r$  in the equation  $r = 7 - 6\cos(7\theta)$ ?

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#24 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

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The point  $(4,1)$  is rotated by an angle of  $\frac{\pi}{6}$  about the origin, resulting in the new point  $(x,y)$ . Find the value of  $8x+2y$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#24 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

---

The point  $(4,1)$  is rotated by an angle of  $\frac{\pi}{6}$  about the origin, resulting in the new point  $(x,y)$ . Find the value of  $8x+2y$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#24 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

---

The point  $(4,1)$  is rotated by an angle of  $\frac{\pi}{6}$  about the origin, resulting in the new point  $(x,y)$ . Find the value of  $8x+2y$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#24 Trigonometry - Hustle**  
**MA $\odot$  National Convention 2011**

---

The point  $(4,1)$  is rotated by an angle of  $\frac{\pi}{6}$  about the origin, resulting in the new point  $(x,y)$ . Find the value of  $8x+2y$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5



**#25 Trigonometry - Hustle**  
**MA@ National Convention 2011**

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Which of the following is false?

- A)  $\sin^2(90^\circ - x) + \sin^2 x = 1$   
B)  $\left(\frac{1}{\sin^2 x}\right) - \left(\frac{1}{\tan x}\right)^2 = 1$   
C)  $\cos^2(-x) + \sin^2(-x) = 1$   
D)  $(\cos^2 x)(\tan^2 x - 1) = 1$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#25 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

Which of the following is false?

- A)  $\sin^2(90^\circ - x) + \sin^2 x = 1$   
B)  $\left(\frac{1}{\sin^2 x}\right) - \left(\frac{1}{\tan x}\right)^2 = 1$   
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D)  $(\cos^2 x)(\tan^2 x - 1) = 1$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#25 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

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D)  $(\cos^2 x)(\tan^2 x - 1) = 1$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#25 Trigonometry - Hustle**  
**MA@ National Convention 2011**

---

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D)  $(\cos^2 x)(\tan^2 x - 1) = 1$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

