#### #1 Calculus – Hustle MAΘ National Convention 2007

A particle moves according to the equations:

$$x(t) = 4t^3 + 6t^2 - 24t - 24$$

$$y(t) = 2t^3 + 3t^2 - 12t + 12$$

$$z(t) = t^3 + 6t^2 + 12t + 20$$

At what instant(s) of time [value(s) of t] is the particle not moving?

NOTE: Time can be negative.

If no such instant of time, write none.

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Round 1 2 3 4 5

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# #2 Calculus – Hustle MA⊕ National Convention 2007

Evaluate:  $\sum_{n=1}^{\infty} \frac{(i\pi)^n}{n!}$ 

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### #3 Calculus – Hustle MAΘ National Convention 2007

For the equation  $x^3 + y^3 + 3x^2y - 3x^2 + 3xy^2 = -11$ , using implicit differentiation find dy/dx at the point (2,-1).

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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

#### #4 Calculus – Hustle MAΘ National Convention 2007

Let *A* be the number of infinite discontinuities and *B* be the number of removable discontinuities in the

function 
$$f(x) = \frac{x^4 - 2x^2 + 1}{x^3 - x}$$
.

What is A - B?

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Answer:

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

#### #5 Calculus – Hustle MA⊕ National Convention 2007

Given  $24 m^2$  of cardboard, you are to construct an open box (that is, a box with no top). In cubic meters, what is the largest volume this box can occupy?

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Answer	:		
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Round 1 2 3 4 5

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

Round 1 2 3 4 5

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### #6 Calculus – Hustle MAΘ National Convention 2007

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Round 1 2 3 4 5

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# #7 Calculus – Hustle MAΘ National Convention 2007

A circle's radius is growing at a rate of 3 m/s. At time t = 0 s the radius of the circle is 1 m. How fast is the area of the circle growing (in  $m^2/s$ ) at time t = 3 s?

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

Round 1 2 3 4 5

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### #8 Calculus – Hustle MAΘ National Convention 2007

Let 
$$A = \begin{pmatrix} \frac{1}{2}e^{2 \cdot \ln x} & 2x - 3 & x - 1 \\ 0 & 3 & x^2 \\ -2 & \ln(4x) & (2x - 3)^3 \end{pmatrix}$$
.

Now replace every entry in *A* with its derivative with respect to x, call this new matrix B. What is the determinant of B?

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

Round 1 2 3 4 5

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# #9 Calculus – Hustle MAΘ National Convention 2007

Let  $f(x) = \sin(ix)$ , what is  $f^{(19)}(x)$ ? (NOTE: i is the imaginary unit)

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Round 1 2 3 4 5

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Round 1 2 3 4 5

### #10 Calculus – Hustle MAΘ National Convention 2007

A particle moves with acceleration  $a(t) = \cos\left(\frac{t}{2}\right)$ . The velocity of this particle is zero at time t = 0. What is the particle's speed at time  $t = 3\pi$ ?

#10 Calculus – Hustle
MA® National Convention 2007

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Amarron		
Answer	•	

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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# #11 Calculus – Hustle MAΘ National Convention 2007

Evaluate:  $\lim_{h\to\infty} \left(1+\frac{3}{h}\right)^h$ 

# #11 Calculus – Hustle MA® National Convention 2007

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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 : \_\_\_\_\_\_

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Round 1 2 3 4 5

# #12 Calculus – Hustle MA© National Convention 2007

Evaluate:  $\int_{3}^{6} \frac{2}{x^2 - 1} dx$ 

# #12 Calculus – Hustle MA® National Convention 2007

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Answer:

Round 1 2 3 4 5

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

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

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

Round 1 2 3 4 5

### #13 Calculus – Hustle MA© National Convention 2007

Let 
$$f(x) = x^2 + 1$$
,  
 $g(x) = \int f'(f(x)) \cdot f'(x) dx$   
and  $g(0) = 2$ , what is  $g(x)$ ?

### #13 Calculus – Hustle MA© National Convention 2007

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A ~	_		
Answer	•		
	•		

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

### #14 Calculus – Hustle MA© National Convention 2007

For  $f(x) = e^{2x} - 10e^x + 12x$ , what is the greatest value of x for which the tangent line is horizontal?

# #14 Calculus – Hustle MAO National Convention 2007

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Answer	•		
	•		

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

# #15 Calculus – Hustle MA© National Convention 2007

# On what interval(s) is

$$f(x) = \frac{x^3}{3} + x^2 - 3x + 1$$
 both concave

up and decreasing? Please, express your answer in interval notation i.e.

$$x \in (a,b) \cup (c,d)$$

# #15 Calculus – Hustle MAΘ National Convention 2007

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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

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

### #16 Calculus – Hustle MA© National Convention 2007

What is the area between the curve  $y = \sin(x)$  and the x-axis, from  $x = -\pi$  to  $x = \pi$ ?

### #16 Calculus – Hustle MAΘ National Convention 2007

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Answer	•		
$\Delta HSWCI$	•		

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

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

# #17 Calculus – Hustle MAO National Convention 2007

Evaluate:  $\int \frac{\sec^2 x}{1 + \tan^2 x} dx$ 

# #17 Calculus – Hustle MA® National Convention 2007

Evaluate:  $\int \frac{\sec^2 x}{1 + \tan^2 x} dx$ 

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

Round 1 2 3 4 5

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

Round 1 2 3 4 5

### #17 Calculus – Hustle MA© National Convention 2007

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### #17 Calculus – Hustle MA© National Convention 2007

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

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

Round 1 2 3 4 5

### #18 Calculus – Hustle MAΘ National Convention 2007

What is the arc length of the curve defined by  $x(t) = 3t^2$ ,  $y(t) = 4t^2$  from t = 0 to t = 2?

# #18 Calculus – Hustle MAO National Convention 2007

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Answer	•		
AIISWEI	•		

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

### #19 Calculus – Hustle MA© National Convention 2007

Evaluate:  $\int_{0}^{\infty} xe^{-x^{2}} dx$ 

# #19 Calculus – Hustle MA® National Convention 2007

Evaluate:  $\int_{0}^{\infty} x e^{-x^2} dx$ 

Answer	•		
A113 W C1	•		

Round 1 2 3 4 5

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

Round 1 2 3 4 5

### #19 Calculus – Hustle MAΘ National Convention 2007

Evaluate:  $\int_{0}^{\infty} x e^{-x^2} dx$ 

#19 Calculus – Hustle MA® National Convention 2007

Evaluate:  $\int_{0}^{\infty} xe^{-x^{2}} dx$ 

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

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

Round 1 2 3 4 5

### #20 Calculus – Hustle MAΘ National Convention 2007

What is the maximum value of the function  $f(x) = -x^3 + 3x + 1$  for  $x \in [-3, 3]$ ?

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Answer	•		
A113WC1	•		

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

#21	Calc	ulus –	Hustle	
ΜA	Θ Na	tional	Convention	2007

What is the first derivative of  $\sin^2(x^2)$  with respect to x?

### #21 Calculus – Hustle MA⊕ National Convention 2007

What is the first derivative of  $\sin^2(x^2)$  with respect to x?

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

Round 1 2 3 4 5

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

Round 1 2 3 4 5

### #21 Calculus – Hustle MAQ National Convention 2007

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### #21 Calculus – Hustle MAQ National Convention 2007

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

Round 1 2 3 4 5

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

#### #22 Calculus – Hustle MAΘ National Convention 2007

Let f(x) be a differentiable, invertible function, such that f(2) = 3. Let  $g(x) = f^{-1}(x)$ . What is f'(2) given that g'(2) = 7 and g'(3) = 11?

## #22 Calculus – Hustle MA⊕ National Convention 2007

Let f(x) be a differentiable, invertible function, such that f(2) = 3. Let  $g(x) = f^{-1}(x)$ . What is f'(2) given that g'(2) = 7 and g'(3) = 11?

Answer	•			
AIISWCI	•			

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

# #23 Calculus – Hustle MA© National Convention 2007

Evaluate:  $\lim_{h\to 0} \frac{(4+h)^2 - (4-h)^2}{2h}$ 

# #23 Calculus – Hustle MA© National Convention 2007

Evaluate:  $\lim_{h\to 0} \frac{(4+h)^2 - (4-h)^2}{2h}$ 

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

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

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

Round 1 2 3 4 5

# #24 Calculus – Hustle MA® National Convention 2007

Evaluate:  $\lim_{x \to 0} \frac{\sin(x) - \cos(x) + 1}{x^3 - 3x^2 + 3x}$ 

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Evaluate:  $\lim_{x\to 0} \frac{\sin(x) - \cos(x) + 1}{x^3 - 3x^2 + 3x}$ 

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

Round 1 2 3 4 5

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

Round 1 2 3 4 5

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

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

Round 1 2 3 4 5

### #25 Calculus – Hustle MA© National Convention 2007

What is f'(1) if  $f(x) = (-x-1)^3 (x+1)^2 (2x-3)$ ?

# #25 Calculus – Hustle MA® National Convention 2007

What is f'(1) if  $f(x) = (-x-1)^3 (x+1)^2 (2x-3)$ ?

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

Round 1 2 3 4 5

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Round 1 2 3 4 5

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

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Round 1 2 3 4 5