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Mu Alpha Theta 2006 National Convention



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Question # P

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Find the equation in slope-intercept form of the tangent line to $f(x) = \ln x^2$ at x = e.

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Question #1

Question # 1

Calculate the slope of the line normal to the graph of $y = \sqrt{1 - x^2}$ at the point where $x = \frac{\sqrt{2}}{2}$.

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Question # 2

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Evaluate: $\int 3(2x^2 + 7)^4 dx$

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Question # 2

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Question #3

Question #3

What is the third smallest natural number with exactly 15 positive integral factors?

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Question #4

The curve $y = x^2$ is revolved about the y-axis to form a container. If liquid flows into the container at a rate of 5 cubic units/min, how fast in units/min is the depth of the liquid, in terms of π , changing when the volume of the liquid is 18π units³?

Question # 4

The curve $y = x^2$ is revolved about the y-axis to form a container. If liquid flows into the container at a rate of 5 cubic units/min, how fast in units/min is the depth of the liquid, in terms of π , changing when the volume of the liquid is 18π units³?



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Question #4

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Question # 5

Evaluate
$$\lim_{h\to 0} \frac{f(x+h)g(x+2h) - f(x)g(x)}{h}$$
 for $f(x) = 2x^2$, $g(x) = \cos x$.

Evaluate
$$\lim_{h\to 0} \frac{f(x+h)g(x+2h) - f(x)g(x)}{h}$$
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Question #5

Evaluate
$$\lim_{h\to 0} \frac{f(x+h)g(x+2h) - f(x)g(x)}{h}$$
 for $f(x) = 2x^2$, $g(x) = \cos x$.

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 for $f(x) = 2x^2$, $g(x) = \cos x$.





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Question # 6

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The total volume of a cylinder is 2000π ft³. The surface area is a maximum when the radius is what length in feet?

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Question #6

Question # 6

The total volume of a cylinder is 2000π ft³. The surface area is a maximum when the radius is what length in feet?

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Question #7

Question #7

Find
$$\frac{dy}{dx}$$
 if $\ln \frac{y}{x} = \sin(x^2 + y^2)$.

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$$\frac{dy}{dx}$$
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Question #7

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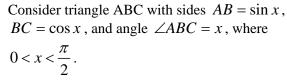
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Question #8

Question #8

Consider triangle ABC with sides $AB = \sin x$, $BC = \cos x$, and angle $\angle ABC = x$, where $0 < x < \frac{\pi}{2}$.

What is the maximum area of triangle ABC?



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What is the maximum area of triangle ABC?





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Question #9

Find x if
$$\int_{1}^{x} \ln(t) dt = -1$$
.

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Question # 10

Question # 10

$$\frac{1}{3} + \frac{1}{2} + \frac{1}{9} + \frac{1}{2} + \frac{1}{27} + \frac{3}{8} + \frac{1}{81} + \frac{1}{4} + \frac{1}{243} + \frac{5}{32} \cdots$$

$$\frac{1}{3} + \frac{1}{2} + \frac{1}{9} + \frac{1}{2} + \frac{1}{27} + \frac{3}{8} + \frac{1}{81} + \frac{1}{4} + \frac{1}{243} + \frac{5}{32} \cdots$$



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Question #10

Question # 10

Evaluate
$$\frac{1}{3} + \frac{1}{2} + \frac{1}{9} + \frac{1}{2} + \frac{1}{27} + \frac{3}{8} + \frac{1}{81} + \frac{1}{4} + \frac{1}{243} + \frac{5}{32} \cdots$$

Evaluate

$$\frac{1}{3} + \frac{1}{2} + \frac{1}{9} + \frac{1}{2} + \frac{1}{27} + \frac{3}{8} + \frac{1}{81} + \frac{1}{4} + \frac{1}{243} + \frac{5}{32} \cdots$$





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Question # 11

Given that
$$f(x) = x^3 - \sin^2(x)$$
, evaluate $f'\left(\frac{\pi}{12}\right)$.

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Question # 12

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Evaluate:
$$\sum_{x=0}^{90} \cos(2x)$$

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Question # 12

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