Name: _____

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Math 10560, Practice Exam 1.

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- No calculators.
- The exam lasts for 1 hour and 15 min.
- Be sure that your name is on every page in case pages become detached.
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1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
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6.	(a)	(b)	(c)	(d)	(e)
7.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)

Please do NOT write in this box.

Multiple Choice	_____
9.	_____
10.	_____
11.	_____
12.	_____
Total	_____

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Multiple Choice

1.(7 pts.) Simplify the following expression for x.

$$x = \log_3 81 + \log_3 \frac{1}{9} \ .$$

(a) $x = 9$ (b) $x = 6$ (c) $x = \ln 9 - \ln 3$

(d) $x = \ln 3$ (e) $x = 2$

2.(7 pts.) The function $f(x) = x^3 + 3x + e^{2x}$ is one-to-one. Compute $(f^{-1})'(1)$.

(a) 0 (b) $\frac{1}{5}$ (c) $\frac{1}{4}$ (d) $\frac{1}{6+e}$ (e) $\frac{1}{6+2e}$

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3.(7 pts.) Differentiate the function

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

(a) $f'(x) = \dfrac{x(x^2-1)^4}{\sqrt{x^2+1}}\left(\dfrac{8}{x^2-1} + \dfrac{1}{x^2+1}\right)$

(b) $f'(x) = \dfrac{(x^2-1)^4}{\sqrt{x^2+1}}\left(\dfrac{4}{x^2-1} - \dfrac{1}{x^2+1}\right)$

(c) $f'(x) = \dfrac{(x^2-1)^4}{\sqrt{x^2+1}}\left(\dfrac{4}{x^2-1} + \dfrac{1}{x^2+1}\right)$

(d) $f'(x) = \dfrac{(x^2-1)^4}{\sqrt{x^2+1}}\left(\dfrac{8}{x^2-1} - \dfrac{1}{x^2+1}\right)$

(e) $f'(x) = \dfrac{x(x^2-1)^4}{\sqrt{x^2+1}}\left(\dfrac{8}{x^2-1} - \dfrac{1}{x^2+1}\right)$

4.(7 pts.) Compute the integral

$$\int_{2e}^{2e^2} \frac{1}{x(\ln\frac{x}{2})^2}dx.$$

(a) 2 (b) $\dfrac{3}{2}$ (c) $\dfrac{1}{2}$ (d) 1 (e) 0

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5.(7 pts.) Which of the following expressions gives the partial fraction decomposition of the function

$$f(x) = \frac{x^2 - 2x + 6}{x^3(x-3)(x^2+4)}?$$

(a) $\dfrac{A}{x^3} + \dfrac{B}{x-3} + \dfrac{C}{x^2+4}$

(b) $\dfrac{A}{x^3} + \dfrac{B}{x-3} + \dfrac{Cx+D}{x^2+4}$

(c) $\dfrac{A}{x^3} + \dfrac{B}{x^2} + \dfrac{C}{x} + \dfrac{D}{x-3} + \dfrac{E}{x^2+4}$

(d) $\dfrac{A}{x^3} + \dfrac{B}{x^2} + \dfrac{C}{x} + \dfrac{D}{x-3} + \dfrac{Ex+F}{x^2+4}$

(e) $\dfrac{A}{x^3} + \dfrac{B}{x^2} + \dfrac{C}{x} + \dfrac{D}{x-3} + \dfrac{E}{x+2} + \dfrac{F}{x-2}$

6.(7 pts.) Find $f'(x)$ if

$$f(x) = x^{\ln x} \ .$$

(a) $2(\ln x)x^{\ln x}$

(b) $x^{\ln x} \ln x$

(c) $2(\ln x)x^{(\ln x)-1}$

(d) $x^{\ln x}(\ln x + 1)$

(e) $x^{(\ln x)-1} \ln x$

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7.(7 pts.) Calculate the following integral.

$$\int_0^1 \frac{\arctan x}{1+x^2}\, dx \ .$$

(a) $\frac{1}{2}$ (b) $\frac{\pi}{8}$ (c) $\frac{\pi^2}{32}$ (d) $\ln 2$ (e) $\frac{\pi^2}{8}$

8.(7 pts.) Evaluate the integral

$$\int_0^{\pi/2} \sin^3(x)\cos^5(x)dx.$$

(a) 0 (b) $\frac{\pi}{2}$ (c) $-\frac{1}{24}$ (d) $\frac{1}{24}$ (e) $\frac{1}{4}$

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Partial Credit

You must show your work on the partial credit problems to receive credit!

9.(11 pts.) Compute the limit

$$\lim_{x\to 2}\left(\frac{x}{2}\right)^{\dfrac{1}{x-2}}.$$

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10.(11 pts.) Evaluate the integral

$$\int x^2 \cos(2x) dx.$$

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11.(11 pts.) Evaluate:

$$\int \frac{1}{3} x^3 \sqrt{9 - x^2}\, dx.$$

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12.(11 pts.) Let $C(t)$ be the concentration of a drug in the bloodstream. As the body eliminates the drug, $C(t)$ decreases at a rate that is proportional to the amount of the drug that is present at the time. Thus $C'(t) = kC(t)$, where k is a constant. The initial concentration of the drug is 4 mg/ml. After 5 hours, the concentration is 3 mg/ml.

(a) Give a formula for the concentration of the drug at time t.

(b) How much drug will there be in 10 hours?

(c) How long will it take for the concentration to drop to 0.5 mg/ml?

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The following is the list of useful trigonometric formulas:

Note: $\sin^{-1} x$ and $\arcsin(x)$ are different names for the same function and $\tan^{-1} x$ and $\arctan(x)$ are different names for the same function.

$$\sin^2 x + \cos^2 x = 1$$

$$1 + \tan^2 x = \sec^2 x$$

$$\sin^2 x = \frac{1}{2}(1 - \cos 2x)$$

$$\cos^2 x = \frac{1}{2}(1 + \cos 2x)$$

$$\sin 2x = 2 \sin x \cos x$$

$$\sin x \cos y = \frac{1}{2}\big(\sin(x - y) + \sin(x + y)\big)$$

$$\sin x \sin y = \frac{1}{2}\big(\cos(x - y) - \cos(x + y)\big)$$

$$\cos x \cos y = \frac{1}{2}\big(\cos(x - y) + \cos(x + y)\big)$$

$$\int \sec\theta = \ln|\sec\theta + \tan\theta| + C$$

$$\int \csc\theta = \ln|\csc\theta - \cot\theta| + C$$

$$\csc\theta = \frac{1}{\sin\theta}, \quad \cot\theta = \frac{1}{\tan\theta}$$

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