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Math 10560, Practice Exam 1.

- The Honor Code is in effect for this examination. All work is to be your own.
- 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.
- Be sure that you have all 13 pages of the test.
- Each multiple choice question is worth 7 points. Your score will be the sum of the best 10 scores on the multiple choice questions plus your score on questions 13-16.

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)
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12.	(a)	(b)	(c)	(d)	(e)

Please do NOT write in this box.

Multiple Choice _____

13. _____

14. _____

15. _____

Total _____

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Multiple Choice

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

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

2.(7 pts.) Solve the following equation for x:

$$\ln(x+4) - \ln x = 1 \ .$$

(a) There is no solution.

(b) $x = \dfrac{4}{e-1}$

(c) $x = \dfrac{4}{1-e}$

(d) $x = e+2$ and $x = e-2$

(e) $x = \dfrac{4}{e-1}$ and $x = \dfrac{4}{e+1}$

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

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4.(7 pts.) Compute the integral

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

(a) 2 (b) $\frac{3}{2}$ (c) $\frac{1}{2}$ (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) $\dfrac{A}{x^3} + \dfrac{B}{x^2} + \dfrac{C}{x} + \dfrac{D}{x-3} + \dfrac{E}{x+2} + \dfrac{F}{x-2}$

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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.) If 100 grams of radioactive material with a half–life of two days are present at day zero, how many grams are left at day three?

(a) $\frac{100}{4^{1/3}}$ (b) $\frac{100}{2^{1/3}}$ (c) $\frac{100}{\sqrt{2}}$ (d) $\frac{100}{\sqrt{8}}$ (e) 50

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9.(7 pts.) $\lim_{x\to 0^+} (\cos x)^{\frac{1}{x^2}} =$

(a) e (b) $e^{-\frac{1}{2}}$ (c) ∞

(d) 1 (e) Does not exist

10.(7 pts.) The integral

$$\int_0^{\pi/2} x\cos(x)dx$$

is

(a) $\frac{\pi}{2} - 1$ (b) divergent (c) 0

(d) $\frac{\sqrt{3}}{2} - \frac{\sqrt{2}}{2}$ (e) $1 - \frac{\pi}{2}$

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11.(7 pts.) Evaluate the integral

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

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

12.(7 pts.) If you expand $\frac{2x+1}{x^3+x}$ as a partial fraction, which expression below would you get?

(a) $\frac{1}{x} + \frac{-x+2}{x^2+1}$

(b) $\frac{-2}{x} + \frac{1}{x^2+1}$

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

(d) $\frac{-1}{x^2} + \frac{1}{x+1}$

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

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Partial Credit

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

13.(12 pts.) Find the integral

$$\int \frac{3x+1}{x^3+x^2}dx.$$

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14.(12 pts.)
Evaluate

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

Note: The formula sheet will help you with this problem.

Write your answer in terms of the original variable x and (if needed) replace all composite trigonometric functions (such as $\cos(\sin^{-1}(x/n))$ etc...) by algebraic combinations of x.

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15. (6 pts.) Please circle "TRUE" if you think the statement is true, and circle "FALSE" if you think the statement is False.

(a)(1 pt. No Partial credit) $\lim_{x\to 0^+} \ln x = 0$.

TRUE FALSE

(b)(1 pt. No Partial credit) $\displaystyle\int \frac{1}{1+x^2} = \ln|1+x^2| + C$.

TRUE FALSE

(c))(1 pt. No Partial credit) $2^x = e^{x\ln(2)}$.

TRUE FALSE

(d))(1 pt. No Partial credit) In solving $\displaystyle\int \sqrt{x^2-4}\,dx$ with trigonometric substitution, the correct substitution to make is $x = 2\sin\theta$.

TRUE FALSE

(e))(1 pt. No Partial credit) If If $f(x) = \tan\left(\sin^{-1}\frac{x}{3}\right)$, then $f(x) = \dfrac{x}{\sqrt{9+x^2}}$ for any number x in the domain of f.

TRUE FALSE

(f))(1 pt. No Partial credit) $\ln\left(\dfrac{1}{x}\right) = -\ln(x)$ for all $x > 0$.

TRUE FALSE

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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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Total _____