Name: _____

Section: _____

Math 10560, Quiz 3
February 7, 2023

- The Honor Code is in effect for this quiz. All work is to be your own.
- Please turn off all cellphones and electronic devices.
- Calculators are NOT allowed
- The quiz lasts for 10 min.

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!					
1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)

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Multiple Choice

1.(2 pts.) Compute the limit

$$\lim_{x\to 0} \frac{\tan(2x)}{3x}$$

(a) $\frac{2}{3}$

(b) $\frac{4}{9}$

(c) $\frac{3}{2}$

(d) The limit does not exist

(e) $\frac{9}{4}$

Solution: As $\lim_{x\to 0} \tan(2x) = \lim_{x\to 0} 3x = 0$, using L'Hôpital's rule for the indeterminate case $\frac{0}{0}$, we have

$$\lim_{x\to 0} \frac{\tan(2x)}{3x} = \lim_{x\to 0} \frac{2\cdot \sec^2(2x)}{3} = \frac{2\cdot 1}{3} = \frac{2}{3}.$$

2.(2 pts.) What is the value of the integral

$$\int_1^{\sqrt{3}} \frac{1}{(1+x^2)\arctan(x)}\, dx$$

(*Hint*: $\arctan 1 = \frac{\pi}{4}$, $\arctan\sqrt{3} = \frac{\pi}{3}$)

(a) $2\ln\left(\frac{2}{3}\right)$

(b) The integral does not converge

(c) $\ln\left(\frac{\pi}{3} - \frac{\pi}{4}\right)$

(d) $\ln\left(\frac{4}{3}\right)$

(e) $\frac{\pi}{3} - \frac{\pi}{4}$

Solution: Let $u = \arctan x$, then $du = \frac{1}{1+x^2}\, dx$, $u(1) = \frac{\pi}{4}$ and $u(\sqrt{3}) = \frac{\pi}{3}$, so that

$$\int_1^{\sqrt{3}} \frac{1}{(1+x^2)\arctan x}\, dx = \int_{\pi/4}^{\pi/3} \frac{du}{u} = \ln|u|\Big|_{\pi/4}^{\pi/3} = \ln\left(\frac{\pi}{3}\right) - \ln\left(\frac{\pi}{4}\right) = \ln\left(\frac{\pi/3}{\pi/4}\right) = \ln\left(\frac{4}{3}\right).$$

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2.	(a)	(b)	(c)	(•)	(e)