Name: ______________________________

Section: ____________________________

Math 10560, Quiz 10
April 18, 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.) Find the Maclaurin series for $f(x) = 3^x$.

(a) $\displaystyle\sum_{n=0}^{\infty} \frac{3^n}{n!} x^n$ (b) $\displaystyle\sum_{n=0}^{\infty} \frac{(\ln 3)^n}{n!} x^n$ (c) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n}{n!} x^{3n}$

(d) $\displaystyle\sum_{n=0}^{\infty} \frac{\ln 3}{n!} x^n$ (e) $\displaystyle\sum_{n=0}^{\infty} \frac{x^n}{(3n)!}$

The Maclaurin series for $f(x)$ is given by $\displaystyle\sum_{n=0}^{\infty} \frac{f^{(n)}(0)}{n!} x^n$.

For $f(x) = 3^x$, the nth derivative is $f^{(n)}(x) = 3^x(\ln 3)^n$, so $f^{(n)}(0) = (\ln 3)^n$.

Plugging into the general formula above we see that the answer is **b**.

2.(2 pts.) Find the radius of convergence of the power series

$$\sum_{n=0}^{\infty} \frac{n+1}{(2n)!}(x-2)^n$$

(a) $R = 1$ (b) $R = 0$ (c) $R = \infty$

(d) $R = \frac{1}{2}$ (e) $R = 2$

Applying the ratio test we have

$$\begin{aligned}
\lim_{n\to\infty} \left|\frac{a_{n+1}}{a_n}\right| &= \lim_{n\to\infty} \left|\frac{(n+2)(x-2)^{\cancel{n+1}}}{(2n+2)!} \cdot \frac{(2n)!}{(n+1)\cancel{(x-2)^n}}\right| \\
&= \lim_{n\to\infty} \left|\frac{(n+2)(x-2)\cancel{(2n)!}}{(n+1)(2n+2)(2n+1)\cancel{(2n)!}}\right| \\
&= |x-2| \lim_{n\to\infty} \frac{n+2}{(n+1)(2n+2)(2n+1)} = 0
\end{aligned}$$

So the series converges when $0 < 1$. This is always true, so the series converges for all x. Thus $R = \infty$, so the answer is **c**.

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