Taylor Series Assignment

Author	**Aaron Tresham**
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Taylor Series Assignment

Question 0

Watch the lecture video here.

Did you watch the video? [Type yes or no.]

Question 1

Use Taylor polynomials to approximate π using the following steps:

- $A = \int_0^1 \frac{1}{1+x^2}\,dx = \arctan(1) - \arctan(0) = \frac{\pi}{4}$
- $T(x) =$ Taylor polynomial of degree 100 of $\frac{1}{1+x^2}$ centered at $x = 0$
- $B = \int_0^1 T(x)\,dx$
- Since A and B are approximately equal, $\pi \approx 4B$. So calculate $4B$ and convert to a decimal.

Question 2

Estimate the value of $\int_0^1 e^{-x^2}\,dx$ as follows:

- Define $T20(x) =$ the Taylor polynomial of degree 20 of e^{-x^2} centered at $x = 0$.
- Calculate $\int_0^1 T20(x)\,dx$.

- Define $T50(x) =$ the Taylor polynomial of degree 50 of e^{-x^2} centered at $x = 0$.
- Calculate $\int_0^1 T50(x)\, dx$.
- Compare your results with the output from Sage's numerical_integral command: 0.746824132812427. [Use the N() command to convert to decimals.]

Question 3

Let $f(x) = e^{\sin(x)}$, $T5(x) =$ the 5th-degree Taylor polynomial of f centered at $x = \pi$, and $T10(x) =$ the 10th-degree Taylor polynomial of f centered at $x = \pi$.

Graph all three on the window $0 \leq x \leq 2\pi$, $0 \leq y \leq 3$. Use black for f, blue for $T5$, and red for $T10$.