- 20 multiple choice questions worth 5 points each.
- Exam is comprehensive

- No calculators!
- For the multiple choice questions, mark your answer on the answer card.

Useful Formulas

$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$	$\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$
$\sum_{i=1}^{n} i^3 = \left(\frac{n(n+1)}{2}\right)^2$	$\sin^2\theta + \cos^2\theta = 1$
$1 + \tan^2\theta = \sec^2\theta$	$1 + \cot^2\theta = \csc^2\theta$
$\sin(A \pm B) = \sin A\cos B \pm \sin B\cos A$	$\cos(A \pm B) = \cos A\cos B \mp \sin A\sin B$
$\tan(A \pm B) = \frac{\tan A + \tan B}{1 \mp \tan A\tan B}$	$\sin A\sin B = \frac{1}{2}\left[\cos(A-B) - \cos(A+B)\right]$
$\cos A\cos B = \frac{1}{2}\left[\cos(A-B) + \cos(A+B)\right]$	$\sin A\cos B = \frac{1}{2}\left[\sin(A+B) + \cos(A-B)\right]$
$\sin^2 x = \frac{1}{2}(1 - \cos 2x)$	$\cos^2 x = \frac{1}{2}(1 + \cos 2x)$
$\sin(2\theta) = 2\sin\theta\cos\theta$	$\cos(2\theta) = \cos^2\theta - \sin^2\theta$
$\int \csc x\,dx = -\ln\lvert\csc x + \cot x\rvert + C$	$\int \sec x\,dx = \ln\lvert\sec x + \tan x\rvert + C$

1. Find a power series representation for $f(x) = \dfrac{2x}{(1-3x)^2}$ centered at 0.

   A. $\displaystyle\sum_{n=1}^{\infty} 2 \cdot 3^n (n+1) x^n$

   B. $\displaystyle\sum_{n=1}^{\infty} -3^n n x^{n-1}$

   C. $\displaystyle\sum_{n=1}^{\infty} 2 \cdot 3^n (n-1) x^n$

   D. $\displaystyle\sum_{n=1}^{\infty} 2 \cdot 3^{n-1} n x^n$

   E. $\displaystyle\sum_{n=1}^{\infty} 3^{n+1} n x^{n-1}$

   F. $\displaystyle\sum_{n=1}^{\infty} -2 \cdot 3^{n-1} x^{n+1}$

   G. $\displaystyle\sum_{n=1}^{\infty} 2 \cdot 3^n x^{2n}$

2. Find the third degree Taylor polynomial, T_3, centered at $x = 2$ for the function $f(x) = \frac{1}{1+x}$.

   A. $f(x) = 1 - x + x^2 - x^3$

   B. $f(x) = \frac{1}{3} - \frac{1}{9}(x-2) + \frac{1}{27}(x-2)^2 - \frac{1}{81}(x-2)^3$

   C. $f(x) = 1 - (x-2) + (x-2)^2 - (x-2)^3$

   D. $f(x) = \frac{1}{3} + \frac{1}{9}(x-2) + \frac{1}{27}(x-2)^2 + \frac{1}{81}(x-2)^3$

   E. $f(x) = 1 + x + x^2 + x^3$

   F. $f(x) = \frac{1}{3} - \frac{1}{9}(x-2) + \frac{2}{27}(x-2)^2 - \frac{6}{81}(x-2)^3$

   G. $f(x) = \frac{1}{3} - \frac{1}{9}x + \frac{1}{27}x^2 - \frac{1}{81}x^3$

3. Find the Taylor series for $f(x) = e^{3x}$ centered at 1.

   A. $\sum_{n=0}^{\infty} \frac{3^n e^3 (x-1)^n}{n!}$

   B. $\sum_{n=0}^{\infty} \frac{3^n (x-1)^n}{n!}$

   C. $\sum_{n=0}^{\infty} \frac{x^n}{n!}$

   D. $\sum_{n=0}^{\infty} \frac{3^n e^3 x^n}{n!}$

   E. $\sum_{n=0}^{\infty} \frac{(x+1)^n}{(3n)!}$

   F. $\sum_{n=0}^{\infty} \frac{3e(x+1)^n}{n!}$

   G. $\sum_{n=0}^{\infty} \frac{3^{n+1} e^3 (x-1)^n}{n!}$

4. Find the value of the series or conclude that it diverges:

$$\sum_{n=0}^{\infty} \frac{(-1)^n \left(\frac{\pi}{2}\right)^{2n+2}}{(2n+1)!} = \frac{\left(\frac{\pi}{2}\right)^2}{1!} - \frac{\left(\frac{\pi}{2}\right)^4}{3!} + \frac{\left(\frac{\pi}{2}\right)^6}{5!} - \frac{\left(\frac{\pi}{2}\right)^8}{7!} + \cdots$$

   A. $\frac{\pi^2}{4}$

   B. $\frac{1}{\sqrt{2}}$

   C. $\frac{\sqrt{3}}{2}$

   D. $\frac{\pi}{2\sqrt{2}}$

   E. $\frac{\pi^2}{4}$

   F. $\frac{\pi}{2}$

   G. $\frac{\pi\sqrt{3}}{2}$

   H. The series diverges.