The Information about Math 105 Final Exam

1. The final exam for Math 105 will be from 3:30 pm to 6:00 pm on April 24. No calculators, books or notes are allowed.

2. The final exam for Math 105 has 6 questions. Question 1 consists of 14 short-answer questions, which are worth $14 \times 3 = 42$ marks. Questions 2, 3, 4, 5 and 6 are longer-answer problems, which are worth 58 marks.

3. The final exam for Math 105 is written according to Math 105 syllabus. Hence, you should know all topics in Math 105 syllabus as posted on the course web page. In particular, the 14 short-answer questions in Question 1 are similar to the practice problems from the textbook, which are given on the common course web page.

4. The final exam for Math 105 DOES NOT have a question asking for the use of the following topics:

(a). Taylor Polynomials in section 9.1.

(b). The binomial Series and Convergence of Taylor Series in section 9.3.

(c). Limits by Taylor Series in section 9.4.

(d). Root test in section 8.5 and interval of convergence in section 9.2.

(e). Midpoint Rule and the Trapezoid Rule in section 7.7.

(f). Telescoping series in section 8.3.

5. The following common formulas occuring in high school math courses may be needed. Students need to memorize these formulas.

$*$ The volume formula of a rectangular box: $V = xyz$, where x, y and z are the dimensions of the box.

$*$ The volume formula of a right cylinder: $V = \pi r^2 h$, where r is the radius of the base, and h is the height of the right cylinder.

$*$ The area formula of a a circle: $A = \pi r^2$, where r is the radius of the circle.

$*$ The circumference formula of a circle: $C = 2\pi r$, where r is the radius of the circle.

$*$ The distance d between (x_1, y_1) and (x_1, y_1): $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$*$ The Pythagorean Theorem: $a^2 + b^2 = c^2$, where a and b are the sides of a right triangle, and c is the hypotenuse.

* If $ax^2 + bx + c = 0$, then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

6. The following formulas will be stated on the exam if they are needed:

MATH 105 Exam Formula Sheet

- **Summation formulas:**

$$\sum_{k=1}^{n} k = \frac{n(n+1)}{2}, \quad \sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}, \quad \sum_{k=1}^{n} k^3 = \frac{n^2(n+1)^2}{4}$$

- **Trigonometric formulas:**

$$\cos^2 x = \frac{1+\cos(2x)}{2}, \quad \sin^2 x = \frac{1-\cos(2x)}{2}, \quad \sin(2x) = 2\sin x \cos x$$

- **Derivatives of some inverse trigonometric functions:**

$$\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}, \qquad \frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$$

- **Simpson's rule:**

$$S_n = \frac{\Delta x}{3}\Big(f(x_0)+4f(x_1)+2f(x_2)+4f(x_3)+\cdots+4f(x_{n-1})+f(x_n)\Big)$$

$$\frac{K(b-a)(\Delta x)^4}{180} \geq E_S, \qquad K \geq |f^{(4)}(x)| \quad \text{on } [a,\, b]$$

- **Indefinite integrals:**

$$\int \sec x dx = \ln|\sec x + \tan x| + C$$

$$\int \frac{dx}{1+x^2} = \tan^{-1} x + C = \arctan x + C$$

- **Probability:**

If X is a continuous random variable with probability density function $f(x)$ with $-\infty < x < \infty$, then the expected value $\mathbf{E}(X)$, the variance $Var(X)$ and the standard deviation $\sigma(X)$ are given by

$$\mathbf{E}(X) = \int_{-\infty}^{\infty} x f(x) dx$$

$$Var(X) = \int_{-\infty}^{\infty} \big(x - \mathbf{E}(X)\big)^2 f(x) dx = \int_{-\infty}^{\infty} x^2 f(x) dx - \big(\mathbf{E}(X)\big)^2$$

$$\sigma(X) = \sqrt{Var(X)}$$

- **Some commonly used Taylor series centered at 0:**

$$\frac{1}{1-x} = \sum_{k=0}^{\infty} x^k, \qquad \text{for } |x| < 1$$

$$e^x = \sum_{k=0}^{\infty} \frac{x^k}{k!}, \qquad \text{for } |x| < \infty$$

$$\sin x = \sum_{k=0}^{\infty} \frac{(-1)^k x^{2k+1}}{(2k+1)!}, \qquad \cos x = \sum_{k=0}^{\infty} \frac{(-1)^k x^{2k}}{(2k)!}, \qquad \text{for } |x| < \infty$$

$$\tan^{-1} x = \sum_{k=0}^{\infty} \frac{(-1)^k x^{2k+1}}{2k+1}, \qquad \text{for } 1 \geq |x|$$

- **Two important limits:**

$$\lim_{x \to 0} \frac{\sin x}{x} = 1, \qquad \lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n = e$$