Your TA: _____ Seat #: ☐ – ☐

Math 105 TOPICS IN MATHEMATICS

FINAL EXAM (Take-home)

May 6 (Wed), 2015

Instructor: Yasuyuki Kachi

Line #: 52920.

ID # : _____ Name : _____

This take-home part of Final Exam is worth 80 points and is due in class Friday, May 15th, 2015. Submission after 10:00 am, May 15th will not be accepted.

- **Be sure to write your answers neatly, precisely, and with complete sentences. You may use notes and handed out materials, but no outside help.**
- **Print off one entire set of this exam. Write answers in the printed sheets. You may not supply your own (blank) sheet.**

[I] (Take-home; 12pts) Convert each of the following expression of numbers in the binary system back into the usual decimal system.

(a) 101. (b) 11000. (c) 11111111 (eight straight 1s).

[**Answers**]: (a) _____ (b) _____ (c) _____

[II] (Take-home; 8pts) Agree

$$e^2 = 1 + \frac{1}{1!}\cdot 2 + \frac{1}{2!}\cdot 2^2 + \frac{1}{3!}\cdot 2^3 + \frac{1}{4!}\cdot 2^4 + \frac{1}{5!}\cdot 2^5 + \cdots .$$

Mimic this and write out the following quantity exactly in this format.

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([II] continued)

$e^{\pi} \; =$ _____.

[III] (Take-home; 12pts) Expand

(1) $x^4 \left(x^4 + x^2 + 1 \right) \; =$ _____.

(2) $\left(x + 1 \right) \left(x + 6 \right) \; =$ _____.

(3) $\left(x - 1 \right) \left(x^6 + x^5 + x^4 + x^3 + x^2 + x + 1 \right) \; =$ _____.

[IV] (Take-home; 8pts) Find

(1) $\dfrac{d}{dx} \, x^{10} \; =$ _____.

(2) $\dfrac{d}{dx} \left(1 + \dfrac{1}{1!}x + \dfrac{1}{2!}x^2 + \dfrac{1}{3!}x^3 + \dfrac{1}{4!}x^4 + \dfrac{1}{5!}x^5 + \dfrac{1}{6!}x^6 + \dfrac{1}{7!}x^7 \right)$

$=$ _____.

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[V] (Take-home; 8pts) (1) $\Big(\cos\theta\Big)^2 + \Big(\sin\theta\Big)^2 =$ _____.

(2) Paraphrase (1):

" The distance between

$$P = \Big(\boxed{}, \quad \boxed{} \Big)$$

and the coordinate origin $O = \Big(0,\ 0\Big)$ is always 1. "

[VI] (Take-home; 6pts) $\int 9x^8\,dx = x^9 + C.$

This means

"An antiderivative of $\boxed{}$ is $\boxed{}$ " .

[VII] (Take-home; 6pts) $\Big($ Do not forget $+ C.\Big)$

(1) $\int 6x^5\,dx =$ _____ .

(2) $\int x^{11}\,dx =$ _____ .

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[VIII] (Take-home; 8pts)

(1) $\sin\Big(x + y\Big) \;=$ _____

$\Big($in terms of $\sin x,\ \cos x,\ \sin y$ and $\cos y\Big)$.

(2) $\cos\Big(x + y\Big) \;=$ _____

$\Big($in terms of $\sin x,\ \cos x,\ \sin y$ and $\cos y\Big)$.

[IX] (Take-home; 6pts)

(1) $\displaystyle\int \cos x\ dx \;=$ _____ , (2) $\displaystyle\int \sin x\ dx \;=$ _____ .

[X] (Take-home; 6pts)

$$\cos x \;=\; 1 - \frac{1}{\square}x^2 + \frac{1}{\square}x^4 - \frac{1}{\square}x^6 + \frac{1}{\square}x^8 - \cdots,$$

$$\sin x \;=\; \frac{1}{\square}x - \frac{1}{\square}x^3 + \frac{1}{\square}x^5 - \frac{1}{\square}x^7 + \cdots.$$