

**QUIZ 1A****(CHAPTER 0: PRELIMINARY TOPICS)****MATH 141 – FALL 2022 – KUNIYUKI****90 POINTS TOTAL**

**No notes or books allowed. A scientific calculator is allowed. Simplify as appropriate.**

You may assume that two-dimensional graphs are in the usual Cartesian  $xy$ -plane (distances in meters). Give exact answers, unless you are told to approximate.

**SHORTER PROBLEMS (48 POINTS)**

- 1) (1 point). The symbol  $\in$  means which of the following? (Box in one.)  
For all                      There exists                      Is a member of
- 2) (6 points total; 2 points each).
- a) Write the **converse** of this given statement:  
“If I am taking 12 units, then I am a full-time student.”
- b) Write the **contrapositive** of this given statement:  
“If I am taking 12 units, then I am a full-time student.”
- c) Which is logically equivalent to the given statement? (Box in one.)  
Its converse                      Its inverse                      Its contrapositive
- 3) (3 points). Simplify completely:  $\frac{x(x+2)}{|x+2|}$  if  $x < -2$ .
- 4) (2 points). Mathematically express the following as an absolute value inequality: The distance between  $x$  and 4 on the real number line is less than or equal to 3.
- 5) (3 points). Solve the correct absolute value inequality from Problem 4); that is, solve the correct answer to Problem 4). Write the solution set in interval form (the form with parentheses and/or brackets).

6) (2 points). Factor completely over  $\mathbb{Z}$  (that is, using only integer coefficients):

$$5x^2 - 11x + 2.$$

7) (5 points). Factor completely over  $\mathbb{Z}$ :  $2x^6 - 54x^3$ .

8) (6 points). Factor completely over  $\mathbb{Z}$ :  $x^{-7} - 4x^{-5}$ , as in class. Write your final answer as a fraction with no negative exponents.

9) (1 point). Write  $\sqrt[8]{x^3}$  in power form (that is,  $x$  raised to an exponent).

10) (6 points total). Fill in the boxes with simplified real numbers to make the statements correct.

$$\text{a) } \frac{9x^2}{16} + 25y^2 = \frac{x^2}{\boxed{\phantom{00}}} + \frac{y^2}{\boxed{\phantom{00}}}$$

$$\text{b) } \frac{3-5x}{x^4} = 3x^{\boxed{\phantom{00}}} - 5x^{\boxed{\phantom{00}}} \quad (x \neq 0)$$

11) (3 points). A circle in the  $xy$ -plane has equation  $(x + 1)^2 + (y - 6)^2 = 16$ .

a) What point is the center of this circle?

b) What is the radius of this circle?

12) (2 points). What is the slope of any line in the  $xy$ -plane that is perpendicular to the line  $y = -4x + 9$ ?

13) (8 points total; 2 points each). Write the formulas for the following.

Description	Formula
The <b>volume</b> of a right circular <b>cylinder</b> with base radius $r$ and height $h$	
The <b>volume</b> of a right circular <b>cone</b> with base radius $r$ and height $h$	
The <b>surface area</b> of a <b>sphere</b> of radius $r$	
The <b>volume</b> of a <b>sphere</b> of radius $r$	

### LONGER PROBLEMS (42 POINTS)

Show all work, simplify as appropriate, and use “good form and procedure” (as in class).

Box in your final answers!

14) Simplify  $\frac{(-3x^2)^3}{x^{7/3} \cdot \sqrt[3]{x^2}}$  completely. (6 points)

- 15) Simplify the following expression completely, as in class.  
Your final answer must be a single non-compound fraction with no nonpositive exponents. (You do not have to rationalize denominators.)  
You may ignore domain issues here. (9 points)

$$\frac{(3x - 5)^{1/3}(4x^3) - (3x - 5)^{-2/3}(x^4)}{(3x - 5)^{2/3}}$$

- 16) For parts a) and b), consider the points  $P(3, -4)$  and  $Q(8, 2)$  in the usual  $xy$ -plane. Write all numerical constants in simplest form. Distance is measured in meters. (14 points total)
- a) Find the distance between the two points (that is, the length of the line segment  $\overline{PQ}$ ). (5 points)
- b) Find the Slope-Intercept Form of the equation of the line  $\overleftrightarrow{PQ}$  that passes through the two points  $P$  and  $Q$ . Hint: This part can be done without part a). (9 points)
- 17) A particular right circular cylinder has lateral surface area 310 square inches and base radius 7 inches. Find the height,  $h$ , of this cylinder. Write an exact answer, and include appropriate units. Also write an approximate answer in decimal form by rounding off to four significant digits. (8 points)

18) Find the **particular** model equation representing the following, as in class:

“ $t$  is directly proportional to  $p$  and inversely proportional to the cube of  $q$ ,”

if  $t$  is 5 when  $p$  is 4 and  $q$  is 2. Make sure your model is in simplified form.

(By “particular,” we mean determine the constant of proportionality.)

(5 points)