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## **MATH 1075**

### **Final Exam**

**Autumn 2019**

#### **Read Instructions Carefully.**

- Write clearly and legibly to receive full credit.
- You have 1 hour 45 minutes to complete this exam. Be careful and check your work.
- The exam will be scored out of 150 points, but there are 153 points possible. Extra credit will be awarded for any scores above 150.
- When applicable, mark answer bubbles completely, like this: ●. Problems with answer bubbles have only ONE correct answer.
- Some problems require you to write your final answer on a designated line. Circle or box all other final answers.
- A calculator may be used given the calculator policy outlined in the syllabus. Even if a calculator is used, you must show all work on each problem to receive full credit.

**Problem 1.** Solve the compound inequality. Select the correct solution set from the options below. (5 pts)

$$2x - 4 \leq -16 \quad \text{or} \quad 3x + 2 \geq 11$$

- $[6, \infty)$
- $[-6, 3]$
- $(-\infty, -10] \cup [3, \infty)$
- $(-\infty, -6] \cup [3, \infty)$
- $(-\infty, \infty)$
- $\emptyset$

**Problem 2.** Solve the absolute value inequality. Select the correct solution set from the options below. (5 pts)

$$6|y + 7| - 8 < 4$$

- $(-9, -5)$
- $(-\infty, -5)$
- $(-\infty, -\frac{5}{6})$
- $(-\infty, -\frac{22}{3})$
- $(-\infty, \infty)$
- $\emptyset$

**Problem 3.** Subtract the rational expressions and simplify. Select the correct answer from the options below. (5 pts)

$$\frac{x}{5x - 8} - \frac{x + 4}{6x}$$

- $-\frac{4}{6x(5x - 8)}$
- $-\frac{4}{x + 8}$
- $\frac{4}{x + 8}$
- $\frac{(x - 4)(x - 8)}{6x(5x - 8)}$
- $\frac{(x + 4)(x - 8)}{6x(5x - 8)}$

**Problem 4.** Multiply the rational expressions and simplify. Select the correct answer from the options below. (5 pts)

$$\frac{3x}{2a} \cdot \frac{8a^3x^5}{15x}$$

- $\frac{45}{16a^4x^3}$   
  $\frac{16a^4x^3}{45}$   
  $\frac{24a^3}{x^6}$   
  $\frac{12a^2x^5}{15}$   
  $\frac{4a^2x^5}{5}$

**Problem 5.** Select the **least common denominator (LCD)** of the two rational expressions from among the options below. (5 pts)

$$\frac{14}{3st(s+3)^2(t-1)} \quad \text{and} \quad \frac{21}{9t^2(s+3)^3(t-2)}$$

- $3t(s+3)^2$   
  $9st^2(s+3)^3(t-1)(t-2)$   
  $9st^3(s+3)^5(t-1)(t-2)$   
  $12st^3(s+3)^5(t-1)(t-2)$   
  $27st^3(s+3)^5(t-1)(t-2)$

**Problem 6.** Simplify the radical expression. Select the correct answer from the options below. (5 pts)

$$\sqrt[3]{108x^7}$$

- $3x^2\sqrt[3]{4x}$   
  $9x^2\sqrt[3]{4x}$   
  $36x^2\sqrt[3]{x}$   
  $x^2 + \sqrt[3]{4x} + 3$   
  $x^2 + \sqrt[3]{4x} + 9$

**Problem 7.** Simplify the sum of radical expressions. Select the correct answer from the options below. (5 pts)

$$5w\sqrt{27u^3} + u\sqrt{75uw^2}$$

- $(5w + u)\sqrt{27u^3 + 75uw^2}$   
  $5uw\sqrt{102u^4w^2}$   
  $5u^3w^2\sqrt{102}$   
  $20uw\sqrt{3u}$   
  $20uw\sqrt{6u}$

**Problem 8.** Let  $f(x) = \sqrt{5x+1}$  and  $g(x) = 2|x-1|$ . Use these functions to find the following values. (3 pts each)

$$(f - g)(3) = \underline{\hspace{2cm}} \quad (f \circ g)(-2) = \underline{\hspace{2cm}} \quad (fg)(3) = \underline{\hspace{2cm}}$$

$$(g \div f)(0) \underline{\hspace{2cm}} \quad (g \circ f)(7) = \underline{\hspace{2cm}}$$

**Problem 9.** Factor completely.

(6 pts)

$$9w^2 - 3y - 27w + wy$$

Write your answer here: \_\_\_\_\_

**Problem 10.** Factor completely.

(6 pts)

$$y^2 + 8y + 12$$

Write your answer here: \_\_\_\_\_

**Problem 11.** Factor completely.

(6 pts)

$$3z^2 + 14z - 24$$

Write your answer here: \_\_\_\_\_

**Problem 12.** Factor completely.

(6 pts)

$$27x^3 - 192x$$

Write your answer here: \_\_\_\_\_

**Problem 13.** Solve the quadratic equation. Show your work.

(7 pts)

$$5x^2 + 9x + 2 = 0$$

**Problem 14.** Solve the quadratic equation. Show your work.

(7 pts)

$$y^2 + 18y + 81 = 20$$

**Problem 15.** Solve the quadratic equation. Show your work.

(7 pts)

$$z^2 + 3z + 2 = 0$$

**Problem 16.** When a constant force acts upon an object, the acceleration ( $a$ ) of the object varies **inversely** with its mass ( $M$ ).

(a) Which equation below models the variation described above? The letter  $k$  represents the constant of variation. (4 pts)

$a = kM$

$M = ak$

$a = \frac{M}{k}$

$a = \frac{k}{M}$

$M = \frac{k}{a^2}$

(b) In a game of billiards, a player struck a mass of  $M = 156$  grams. The ball accelerated at a rate of  $a = 42 \text{ m/s}^2$ . Find the constant of variation,  $k$ . (3 pts)

Write your answer here:  $k =$  \_\_\_\_\_

(c) Suppose the billiards player were to strike a marble with mass  $M = 7$  grams with the same amount of force. What would be the marble's acceleration? (3 pts)

Write your answer here:  $a =$  \_\_\_\_\_

**Problem 17.** Solve the rational equation.

(12 pts)

$$\frac{2}{w+4} = \frac{8}{w+4} + 6$$

**Problem 18.** Solve the radical equation.

(12 pts)

$$u = \sqrt{11u - 24}$$



**Problem 19.** Let  $f(x) = 4x^2 + 16x + 19$ .

(a) Select the equation that represents  $f(x)$  written in **vertex form**. (5 pts)

- $f(x) = 4x(4x + 4) + 3$
- $f(x) = 4(x - 2)^2 + 3$
- $f(x) = 4(x + 2)^2 + 3$
- $f(x) = 4(x + 4)^2 + 19$
- $f(x) = 4(x - 4)^2 + 19$

(b) Select the equation of the axis of symmetry of  $f(x)$ . (3 pts)

- $x = 2$
- $x = -2$
- $y = 2$
- $y = 4$
- None of the above

(c) What is the **minimum** value of the function? (3 pts)

Write your answer here: \_\_\_\_\_

(d) At which value of  $x$  does  $f(x)$  reach its minimum value? (3 pts)

Write your answer here: \_\_\_\_\_

(e) Fill in the blanks with the coordinates of the vertex of  $f(x)$ . (4 pts)

(\_\_\_\_\_, \_\_\_\_\_)

(f) True or False? If  $f(x)$  were graphed, the vertex of the function would lie to the left of the  $y$ -axis. (3 pts)

TRUE      FALSE

(g) True or False? If  $f(x)$  were graphed, the vertex of the function would lie above the  $x$ -axis. (3 pts)

TRUE      FALSE

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