Math 30-2
Unit 4: Exam
Rational Expressions and Equations

Please have your calculator cleared by a staff member
Formula sheet attached

Name:_____

Mark:_____/20

Mathematics 30–2 Formula Sheet

Relations and Functions

Graphing Calculator Window Format

x: $[x_{min}, x_{max}, x_{scl}]$

y: $[y_{min}, y_{max}, y_{scl}]$

Exponents and Logarithms

$$y = a^x \leftrightarrow x = \log_a y$$

$$\log_b c = \frac{\log_a c}{\log_a b}$$

Laws of Logarithms

$$\log_a(M \cdot N) = \log_a M + \log_a N$$

$$\log_a\left(\frac{M}{N}\right) = \log_a M - \log_a N$$

$$\log_a(M^n) = n \log_a M$$

Exponential functions

$$y = a \cdot b^x$$

Sinusoidal functions

$$y = a \cdot \sin(bx + c) + d$$

$$\text{Period} = \frac{2\pi}{b}$$

Quadratic equations

For $ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Probability

$n! = n(n-1)(n-2)\ldots 3 \cdot 2 \cdot 1$,
where $n \in N$ and $0! = 1$

$${}_nP_r = \frac{n!}{(n-r)!}$$

$${}_nC_r = \frac{n!}{(n-r)!r!}$$

$${}_nC_r = \binom{n}{r}$$

$$P(A \cup B) = P(A) + P(B)$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A \cap B) = P(A) \cdot P(B)$$

$$P(A \cap B) = P(A) \cdot P(B \mid A)$$

Logical Reasoning

- A' Complement
- $\varnothing$ Empty set
- $\cap$ Intersection
- $\subset$ Subset
- $\cup$ Union

Name: _____ **Date:** _____ **ID:** **Version**

Mathematics 30-2 Chapter 4: Rational Expressions and Equations Unit Exam

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ **1.** Identify the rational expression that is equivalent to $\frac{1-x^2}{6}$.

A. $\frac{3-3x^2}{2}$ **B.** $\frac{x-x^3}{6x}$ **C.** $\frac{2-x^2}{12}$ **D.** $\frac{x-x^2}{6x}$

____ **2.** Identify the rational expression that is equivalent to $\frac{3x+2x^2}{x^2-6x}$.

A. $\frac{9x+6x^2}{3x^2-12x}$ **B.** $\frac{3x+2}{1-6x}$ **C.** $\frac{3+2x}{x-6}$ **D.** $\frac{6x+4x^2}{3x^2-12x}$

____ **3.** Simplify $\frac{42d^2}{-72d^3}$.

A. $\frac{14}{-12d^2}, d \neq 0$

B. $\frac{21d}{-36d^2}, d \neq 0$

C. $\frac{14d}{-24}, d \neq 0$

D. $\frac{7}{-12d}, d \neq 0$

____ **4.** Simplify $\frac{3 + 18p}{36p^2}$.

A. $\frac{1 + 6p}{12p^2}, p \neq 0$

B. $\frac{1 + 2}{4p}, p \neq 0$

C. $\frac{p + 6}{12p^2}, p \neq 0$

D. $\frac{3 + 2p}{6p}, p \neq 0$

____ **5.** Simplify $\frac{15b + 50b^3}{20b^3 - 45b}$.

A. $\frac{3 + 10b^2}{4b^2 - 9}, b \neq 0, \pm\frac{3}{2}$

B. $\frac{1 + 5b^3}{2b^3 - 3}, b \neq 0, \pm\frac{3}{2}$

C. $\frac{3 + 5b^2}{2b - 9}, b \neq 0, \pm\frac{3}{2}$

D. $\frac{3 + 10b}{2b - 9}, b \neq 0, \pm\frac{3}{2}$

____ **6.** Determine the **lowest** common denominator for the pair $\frac{5 - e}{18e}$ and $\frac{1}{4e^3}$.

A. $18e + 4e^3$ **B.** $4.5e^2$ **C.** $36e^3$ **D.** $72e^4$

____ **7.** Determine all the non-permissible values of the variable.

$$\frac{3}{5g} \div \frac{5g-15}{2g+1}$$

A. $g \neq 0, \frac{1}{2}$

B. $g \neq 0, \frac{1}{2}, 3$

C. $g \neq 0, -\frac{1}{2}$

D. $g \neq 0, -\frac{1}{2}, 3$

____ **8.** Simplify $\frac{1}{7n^2} + \frac{n+1}{5n}$.

A. $\frac{5+7n^2+7n}{35n^2}, n \neq 0$

B. $\frac{5+7n^2+7n}{35n}, n \neq 0$

C. $\frac{5+14n}{35n^2}, n \neq 0$

D. $\frac{5+14n}{35n}, n \neq 0$

____ **9.** A simplified form of $\frac{3}{a^2-9} \div \frac{3a-6}{a-3}$, where $x \neq 2, \pm 3$, is

A. $\frac{1}{(a-3)(a-2)}$

B. $\frac{1}{(a+3)(a-3)}$

C. $\frac{1}{(a+3)(a-2)}$

D. $\frac{9(a-2)}{(a-3)^2(a+3)}$

____ **10.** Simplify $\frac{y}{y+5} - \frac{5}{y^2-25}$.

A. $\frac{y^2-5}{y^2-25}, y \neq -5, 5$

B. $\frac{y-5}{(y+5)^2(y-5)}, y \neq -5, 5$

C. $\frac{y^2-5y-5}{y^2-25}, y \neq -5, 5$

D. $\frac{y^2-5y-5}{y^2+5}, y \neq -5, 5$

____ **11.** Identify the root(s) of the following equation.

$$\frac{2}{x} = \frac{-x+7}{6}$$

A. $x = 3$ **B.** $x = 4$ **C.** $x = 5$ **D.** A and B

____ **12.** Salt water is flowing into a large tank that contains pure water. The concentration of salt in the tank, c, in grams per liter (g/L), at time t, in minutes, is given by the formula:

$$c = \frac{10t}{25+t}$$

When does the salt concentration in the tank reach 2 g/L?

A. $t = 5.75$ **B.** $t = 6.25$ **C.** $t = 7.5$ **D.** never

Brian tried to determine the non-permissible values for an expression, as shown below.

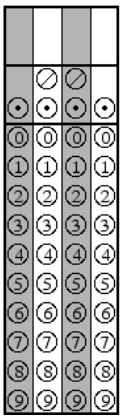
$\frac{2t - 6t^3}{8t - 14t^2}$	a) To determine the non-permissible values, I looked for the values that make the denominator equal to zero.
Denominator: $8t - 14t^2 = 0$ $2t(4 - 7t) = 0$	b) I set the denominator equal to 0 and factored the expression on the left.
$2t = 0$ or $4 - 7t = 0$ $t = 0$ $\quad 4 = -7t$ $t = -\frac{4}{7}$	c) I set both factors equal to zero. I solved each equation separately.
$\frac{2t - 6t^3}{8t - 14t^2}, t \neq 0, t \neq -\frac{4}{7}$	d) $t = 0$ and $t = -\frac{4}{7}$ are non-permissible values of the variable in the rational expression.

____ **13.** Identify the step where Brian made his first error.

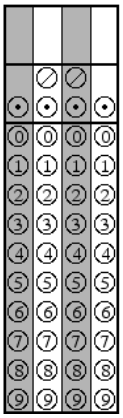
A. A **B.** B **C.** C **D.** D

Numeric Response

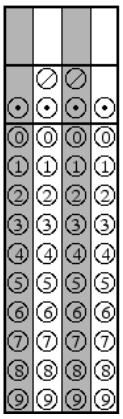
1. In the expression $\frac{3x(x + 4.50)}{(x + 1.50)(5.75 - x)(x + 2.85)}$, the **positive** non-permissible value for x, to the nearest hundredth is, _____.



2. When $\frac{5x - 1}{4} + \frac{2 - 3x}{7}$ is simplified and written in the form $\frac{ax + b}{28}$, the value of a is _____.



3. In the equation $\frac{5}{x + 1} + \frac{2}{3} = 1$, where $x \neq -1$, the value of x is _____.



Problem

1. Over a 10 km cross-country ski course, a skier found that his average speed on icy conditions is 4 km/h faster than his average speed in powder snow conditions. AS will, his time is 5 minutes faster. The coach represented the speed of the skier in these two snow conditions with the following algebraic terms.

x = Average speed of the skier in powder snow conditions
$x+4$ = Average speed of the skier in icy conditions

The coach also wrote the following equation relating the times of the skier.

$$time = \frac{dist.}{speed} \qquad \frac{10}{x} - \frac{10}{x+4} = \frac{1}{12}$$

a) In the equation above, the expression represents the time required for this skier to complete a 10 km cross-country ski course in powder snow conditions is: (1 mark)

b) Explain what $\frac{1}{12}$ represents in the equation above. (1 mark)

The coach simplified the equation to $x^2 + 4x - 480 = 0$.

c) Show how you would solve this quadratic equation to find x, and then use your solution to determine the skier's average speed in **icy conditions**. (2 marks)