

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

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

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

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

$$\text{For } ax^2 + bx + c = 0$$

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

Probability

$$n! = n(n-1)(n-2)\dots 3 \cdot 2 \cdot 1, \\ \text{where } n \in N \text{ and } 0! = 1$$

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

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

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

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

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

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

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

Logical Reasoning

A' Complement

$\emptyset$ Empty set

$\cap$ Intersection

$\subset$ Subset

$\cup$ Union

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. $\frac{14}{-12d^2}, d \neq 0$ C. $\frac{14d}{-24}, d \neq 0$
B. $\frac{21d}{-36d^2}, d \neq 0$ D. $\frac{7}{-12d}, d \neq 0$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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 $4 - 7t = 0$ $t = 0$ $4 = -7t$ $t = -\frac{4}{7}$	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

Problem

- 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.

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

- 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)

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

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

- 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)