

Name and section: _____

Instructor's name: _____

- **Please do not open exam until instructed to begin.**
- This exam is to be completed in the allotted time period of 50 minutes.
- There are 17 problems which appear on the fronts and backs of the pages of this exam.
- You may earn a total of 96 points.
- Read each question carefully.
- Credit may not be given without sufficient supporting work.
- Simplify answers when possible.
- The use of cell phones, books, or notes are not permitted while taking this exam.
- Approved calculators are allowed.

1. Factor completely.

$$18wz^2 - 27w^2z$$

2. Factor completely.

$$x^2 + 6x - 27$$

3. Factor completely.

$$6x^2 + x - 5$$

4. Factor completely.

$$81a^2 - 49$$

5. Factor completely.

$$49x^3y - 28x^2y + 4xy$$

6. The height in feet that a model rocket attains is given by $h(t) = -5t^2 + 11t + 12$ where t is the time measured in seconds. How many seconds will it take until the rocket finally reaches the ground? (Hint: ground level is $h = 0$)

7. Simplify.

$$\frac{3x^2 - 11x - 4}{x^2 + x - 20}$$

8. Simplify.

$$\frac{49 - x^2}{2x^2 - 9x - 35}$$

9. Multiply.

$$\frac{x^2 + x - 30}{2x - 10} \times \frac{5x + 15}{x^2 + 4x - 12}$$

10. Divide.

$$\frac{2x^2 + 16xy + 32y^2}{x^2 + 9xy + 8y^2} \div \frac{9x + 36y}{x + y}$$

11. Subtract.

$$\frac{5x}{x^2 - 64} - \frac{4}{x + 8}$$

12. Add.

$$\frac{4}{x^2 + 9x + 14} + \frac{3}{x^2 + 6x + 8}$$

13. Simplify.

$$\frac{\frac{10}{x^2 - 25}}{\frac{7}{x+5} + \frac{7}{x-5}}$$

14. Solve for x .

$$\frac{4x}{x^2 - 4} = \frac{5}{x + 2} - \frac{2}{x - 2}$$

15. Solve for a .

$$\frac{8a - 1}{6a + 8} = \frac{3}{4}$$

16. A 5-gallon can of paint covers 250 square feet. How many gallons of paint do you need to cover 400 square feet?
17. On a map the distance between two mountains is $4\frac{1}{2}$ inches. The actual distance is 104 miles. Russ is camped at a location that on the map is $\frac{3}{4}$ inch from the base of the mountain. How many miles is he from the base of the mountain? Round to the nearest tenth.

Solutions

1. Factor completely.

$$18wz^2 - 27w^2z$$

$9wz$	2 pts to here
$9wz(2z - 3w)$	4 pts to here
Award 3 points if the correct GCF is found, but there is a minor mistake in factoring.	

2. Factor completely.

$$x^2 + 6x - 27$$

$(x + 9)(x - 3)$	4 pts
Reversed signs award 2 pts for the problem	
One correct factor award 1 pt for the problem	

3. Factor completely.

$$6x^2 + x - 5$$

$6x^2 + 6x - 5x - 5$	1 pt to here
$6x(x + 1) - 5(x + 1)$	2 pt to here
$(6x - 5)(x + 1)$	4 pts to here
Reversed signs award 3 pts for the problem	
One correct factor award 2 pt for the problem	

4. Factor completely.

$$81a^2 - 49$$

$(9a - 7)(9a + 7)$	4 pts
Incorrect signs, numbers are correct	3 pts
One correct factor award	2 pts

5. Factor completely.

$$49x^3y - 28x^2y + 4xy$$

$xy(49x^2 - 28x + 4)$	2 pts to here
$xy(7x - 2)^2$	4 pts
Incorrect sign, numbers are correct	3 pts

6. The height in feet that a model rocket attains is given by $h(t) = -5t^2 + 11t + 12$ where t is the time measured in seconds. How many seconds will it take until the rocket finally reaches the ground? (Hint: ground level is $h = 0$)

$0 = -5t^2 + 11t + 12$	2 pts to here
$0 = -(5t + 4)(t - 3)$	4 pts to here
$t - 3 = 0$	
$5t + 4 = 0$	6 pts to here
$t = -4/5$ second	8 pts given both answers
$t = 3$ seconds	10 pts if student shows
that 3 seconds is only answer	
(9 points if units are left off)	

7. Simplify.

$$\frac{3x^2 - 11x - 4}{x^2 + x - 20}$$

Partial factoring of only the denominator	1 pt
Partial factoring of only the numerator	2 pts to here
$\frac{(3x+1)(x-4)}{(x+5)(x-4)}$	3 pts to here
$\frac{3x+1}{x+5}$	4 pts to here

8. Simplify.

$$\frac{49 - x^2}{2x^2 - 9x - 35}$$

Partial factoring of only denominator or numerator	1 pt
$\frac{(7-x)(7+x)}{(2x+5)(x-7)}$	2 pts to here
$\frac{(7-x)(7+x)}{-(2x+5)(7-x)}$	3 pts to here
$-\frac{7+x}{2x+5}$	4 pts to here

9. Multiply.

$$\frac{x^2 + x - 30}{2x - 10} \times \frac{5x + 15}{x^2 + 4x - 12}$$

Factoring of equivalent of one rational expression	2 pt
$\frac{(x-5)(x+6)}{2(x-5)} \times \frac{5(x+3)}{(x-2)(x+6)}$	4 pts to here
$\frac{5(x+3)}{2(x-2)}$	6 pts to here

10. Divide.

$$\frac{2x^2 + 16xy + 32y^2}{x^2 + 9xy + 8y^2} \div \frac{9x + 36y}{x + y}$$

Factoring of equivalent of one rational expression	2 pt
$\frac{2(x+4y)(x+4y)}{(x+8y)(x+y)} \times \frac{x+y}{9(x+4y)}$	3 pts to here
$\frac{2(x+4y)}{9(x+8y)}$	6 pts to here

11. Subtract.

$$\frac{5x}{x^2 - 64} - \frac{4}{x + 8}$$

Factoring of equivalent of one rational expression 2 pt

$$\frac{5x}{(x+8)(x-8)} - \frac{4(x-8)}{(x+8)(x-8)} \quad 3 \text{ pts to here}$$

$$\frac{5x-4x+32}{(x+8)(x-8)} \quad 5 \text{ pts to here}$$

$$(4 \text{ pts if } 3x - 2x - 32)$$

$$\frac{x+32}{(x+8)(x-8)} \quad 6 \text{ pts to here}$$

$$5 \text{ pts if } \frac{x-32}{(x+8)(x-8)}$$

12. Add.

$$\frac{4}{x^2 + 9x + 14} + \frac{3}{x^2 + 6x + 8}$$

$$\frac{4}{(x+7)(x+2)} + \frac{3}{(x+2)(x+4)} \quad 2 \text{ pts to here}$$

$$\frac{4(x+4)}{(x+7)(x+2)(x+4)} + \frac{3(x+7)}{(x+7)(x+2)(x+4)} \quad 3 \text{ pts to here}$$

$$\frac{4x+16+3x+21}{(x+4)(x+2)(x+7)} \quad 5 \text{ pts to here}$$

$$\frac{7x+37}{(x+4)(x+2)(x+7)} \quad 6 \text{ pts to here}$$

13. Simplify.

$$\frac{\frac{10}{x^2-25}}{\frac{7}{x+5} + \frac{7}{x-5}}$$

Method 1

$$\frac{\frac{10}{x^2-25}}{\frac{7(x-5)}{(x+5)(x-5)}} + \frac{7(x+5)}{(x+5)(x-5)} \quad 2 \text{ pts to here}$$

$$\frac{\frac{10}{x^2-25}}{\frac{14x}{(x+5)(x-5)}} \quad 3 \text{ pts to here}$$

$$\frac{10}{(x+5)(x-5)} \times \frac{(x+5)(x-5)}{14x} \quad 4 \text{ pts to here}$$

$$\frac{10}{14x} \quad 5 \text{ pts to here}$$

$$\frac{5}{7x} \quad 6 \text{ pts to here}$$

Method 2

$$\frac{(x+5)(x-5)}{(x+5)(x-5)} \times \frac{\frac{10}{x^2-25}}{\frac{7}{x+5} + \frac{7}{x-5}} \quad 2 \text{ pts to here}$$

$$\frac{10}{7(x-5)+7(x+5)} \quad 4 \text{ pts to here}$$

$$\frac{10}{14x} \quad 5 \text{ pts to here}$$

$$\frac{5}{7x} \quad 6 \text{ pts to here}$$

14. Solve for x .

$$\frac{4x}{x^2 - 4} = \frac{5}{x + 2} - \frac{2}{x - 2}$$

$(x+2)(x-2)\frac{4x}{(x+2)(x-2)} = \frac{(x+2)(x-2)5}{x+2} - \frac{(x+2)(x-2)2}{x-2}$	2 pts to here
$4x = 5(x-2) - 2(x+2)$	3 pts to here
$4x = 5x - 10 - 2x - 4$	4 pts to here
$4x = 3x - 14$	5 pts to here
$x = -14$	6 pts to here

15. Solve for
- a
- .

$$\frac{8a-1}{6a+8} = \frac{3}{4}$$

$4(8a-1) = 3(6a+8)$	3 pts to here
$32a-4 = 18a+24$	4 pts to here
$14a = 28$	5 pts to here
$a = 2$	6 pts to here

16. A 5-gallon can of paint covers 250 square feet. How many gallons of paint do you need to cover 400 square feet?

$\frac{5}{250} = \frac{x}{400}$	4 pts to here
$5 \cdot 400 = 250x$	6 pts to here
$x = 8 \text{ gallons}$	8 pts to here

17. On a map the distance between two mountains is
- $4\frac{1}{2}$
- inches. The actual distance is 104 miles. Russ is camped at a location that on the map is
- $\frac{3}{4}$
- inch from the base of the mountain. How many miles is he from the base of the mountain? Round to the nearest tenth.

$\frac{4.5 \text{ in}}{104 \text{ miles}} = \frac{.75 \text{ in}}{x \text{ miles}}$	4 pts to here
$4.5x = (.75)(104)$	6 pts to here
$x = 17.3$	7 pts to here
$x = 17.3 \text{ miles}$	8 pts to here