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.

   $9x^2 - 13x + 4$

4. Factor completely.

   $49a^2 - 64$

5. Factor completely.

$$25x^3y - 30x^2y + 9xy$$

6. The height in feet that a model rocket attains is given by $h(t) = -5t^2 + 13t + 6$ 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.

$$\frac{x^2 + 10x + 21}{2x^2 + 11x - 21}$$

8. Simplify.

$$\frac{2x^2 - 11x + 12}{16 - x^2}$$

9. Multiply.

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

10. Divide.

$$\frac{x^2 - 8x + 15}{x^2 + 10x - 24} \div \frac{x^2 - 3x - 10}{x^2 + 14x + 24}$$

11. Subtract.

$$\frac{7x}{x^2 - 36} - \frac{6}{x + 6}$$

12. Add.
$$\frac{7}{x^2 + 5x + 6} + \frac{4}{x^2 + 10x + 21}$$

13. Simplify.
$$\frac{\frac{14}{x^2-49}}{\frac{4}{x+7} + \frac{4}{x-7}}$$

14. Solve for x.
$$\frac{4x}{x^2 - 4} = \frac{5}{x + 2} - \frac{2}{x - 2}$$

15. Solve for a.
    $$\frac{a+4}{7a-2} = \frac{1}{2}$$

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 $7\frac{1}{2}$ inches. The actual distance is 148 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.

    $9x^2 - 13x + 4$

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

4. Factor completely.

    $49a^2 - 64$

$(7a - 8)(7a + 8)$	4 pts
Incorrect signs, numbers are correct	3 pts
One correct factor award	2 pts

5. Factor completely.

    $25x^3y - 30x^2y + 9xy$

$xy(25x^2 - 30x + 9)$	2 pts to here
$xy(5x - 3)^2$	4 pts
Incorrect sign, numbers are correct	3 pts

6. The height in feet that a model rocket attains is given by $h(t) = -5t^2 + 13t + 6$ 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 $h = 0$)

$0 = -5t^2 + 13t + 6$	2 pts to here
$0 = -(5t + 2)(t - 3)$	4 pts to here
$t - 3 = 0$	
$5t + 2 = 0$	6 pts to here
$t = -2/5$ 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.

$$\frac{x^2 + 10x + 21}{2x^2 + 11x - 21}$$

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

8. Simplify.

$$\frac{2x^2 - 11x + 12}{16 - x^2}$$

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

9. Multiply.

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

Factoring of equivalent of one rational expression	2 pt
$\frac{2(x-5)}{x-4} \times \frac{(x+4)(x+1)}{(x-5)(x+1)}$	4 pts to here
$\frac{2(x+4)}{x-4}$	6 pts to here

10. Divide.

$$\frac{x^2 - 8x + 15}{x^2 + 10x - 24} \div \frac{x^2 - 3x - 10}{x^2 + 14x + 24}$$

Factoring of equivalent of one rational expression	2 pt
$\frac{(x-3)(x-5)}{(x+12)(x-2)} \times \frac{(x+12)(x+2)}{(x-5)(x+2)}$	3 pts to here
$\frac{x-3}{x-2}$	6 pts to here

11. Subtract.

$$\frac{7x}{x^2 - 36} - \frac{6}{x + 6}$$

Factoring of equivalent of one rational expression	2 pt
$\frac{7x}{(x+6)(x-6)} - \frac{6(x-6)}{(x+6)(x-6)}$	3 pts to here
$\frac{7x-6x+36}{(x+6)(x-6)}$	5 pts to here
(4 pts if $7x - 6x - 36$)	
$\frac{x+36}{(x+6)(x-6)}$	6 pts to here
5 pts if $\frac{x-36}{(x+6)(x-6)}$	

12. Add.

$$\frac{7}{x^2 + 5x + 6} + \frac{4}{x^2 + 10x + 21}$$

$\frac{7}{(x+3)(x+2)} + \frac{4}{(x+7)(x+3)}$	2 pts to here
$\frac{7(x+7)}{(x+3)(x+2)(x+7)} + \frac{4(x+2)}{(x+7)(x+3)(x+2)}$	3 pts to here
$\frac{7x+49+4x+8}{(x+3)(x+2)(x+7)}$	5 pts to here
$\frac{11x+57}{(x+3)(x+2)(x+7)}$	6 pts to here

13. Simplify.

$$\frac{\frac{14}{x^2-49}}{\frac{4}{x+7} + \frac{4}{x-7}}$$

Method 1	
$\frac{\frac{14}{x^2-49}}{\frac{4(x-7)}{(x+7)(x-7)}} + \frac{4(x+7)}{(x+7)(x-7)}$	2 pts to here
$\frac{\frac{14}{x^2-49}}{\frac{8x}{(x+7)(x-7)}}$	3 pts to here
$\frac{14}{(x+7)(x-7)} \times \frac{(x+7)(x-7)}{8x}$	4 pts to here
$\frac{14}{8x}$	5 pts to here
$\frac{7}{4x}$	6 pts to here
Method 2	
$\frac{(x+7)(x-7)}{(x+7)(x-7)} \times \frac{\frac{14}{x^2-49}}{\frac{4}{x+7} + \frac{4}{x-7}}$	2 pts to here
$\frac{14}{4(x-7)+4(x+7)}$	4 pts to here
$\frac{14}{8x}$	5 pts to here
$\frac{7}{4x}$	6 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.

$$\frac{a+4}{7a-2} = \frac{1}{2}$$

$2(a+4) = 7a-2$	3 pts to here
$2a+8 = 7a-2$	4 pts to here
$5a = 10$	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?

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

17. On a map the distance between two mountains is $7\frac{1}{2}$ inches. The actual distance is 148 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.

$\frac{7.5in}{148miles} = \frac{.75in}{xmiles}$	4 pts to here
$7.5x = (.75)(148)$	6 pts to here
$x = 14.8$	7 pts to here
$x = 14.8 miles$	8 pts to here