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 20 problems which appear on the fronts and backs of the pages of this exam.
- You may earn a total of 124 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.

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

6. The height in feet that a model rocket attains is given by $h(t) = -5t^2 - 23t + 10$ 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.

   $$\frac{x^2 - 9x + 18}{2x^2 - 9x + 9}$$

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.
$$\frac{3}{x^2+9x+20}+\frac{2}{x^2+10x+24}$$

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

14. Solve for x.
$$\frac{5x}{x^2-4}=\frac{8}{x+2}-\frac{4}{x-2}$$

15. Solve for a.
$$\frac{a+2}{3a+1} = \frac{1}{2}$$

16. A 4-gallon can of paint covers 240 square feet. How many gallons of paint do you need to cover 360 square feet?

17. On a map the distance between two mountains is $3\frac{1}{2}$ inches. The actual distance is 136 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.

18. Simplify.
$(-4x^{\frac{1}{8}}y^{\frac{1}{2}})(2x^{\frac{3}{4}}y^{\frac{1}{3}})$

19. Simplify.
$\sqrt[3]{64a^{12}b^{30}}$

20. Simplify.
$4\sqrt{50x} + 3\sqrt{2x} + \sqrt{72x}$

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.

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

$xy(25x^2 - 30x + 9)$	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 $h(t) = -5t^2 - 23t + 10$ 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 $h = 0$)

$0 = -5t^2 + 23t + 10$	2 pts to here
$0 = -(5t + 2)(t - 5)$	4 pts to here
$t - 5 = 0$	
$5t + 2 = 0$	6 pts to here
$t = -2/5$ second	8 pts given both answers
$t = 5$ seconds	10 pts if student shows
that 5 seconds is only answer	
(9 points if units are left off)	

7. Simplify.

$$\frac{x^2 - 9x + 18}{2x^2 - 9x + 9}$$

Partial factoring of only the numerator	1 pt
Partial factoring of only the denominator	2 pts to here
$\frac{(x-6)(x-3)}{(2x-3)(x-3)}$	3 pts to here
$\frac{x-6}{2x-3}$	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
$\frac{5x}{(x+8)(x-8)}-\frac{4(x-8)}{(x+8)(x-8)}$	3 pts to here
$\frac{5x-4x+32}{(x+8)(x-8)}$	5 pts to here
(4 pts if $3x-2x-32$)	
$\frac{x+32}{(x+8)(x-8)}$	6 pts to here
5 pts if $\frac{x-32}{(x+8)(x-8)}$	

12. Add.

$$\frac{3}{x^2+9x+20}+\frac{2}{x^2+10x+24}$$

$\frac{3}{(x+4)(x+5)}+\frac{2}{(x+6)(x+4)}$	2 pts to here
$\frac{3(x+6)}{(x+4)(x+5)(x+6)}+\frac{2(x+5)}{(x+6)(x+4)(x+5)}$	3 pts to here
$\frac{3x+18+2x+10}{(x+4)(x+5)(x+6)}$	5 pts to here
$\frac{5x+28}{(x+4)(x+5)(x+6)}$	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.

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

$(x+2)(x-2)\frac{5x}{(x+2)(x-2)} = \frac{(x+2)(x-2)8}{x+2} - \frac{(x+2)(x-2)4}{x-2}$	2 pts to here
$5x = 8(x-2) - 4(x+2)$	3 pts to here
$5x = 8x - 16 - 4x - 8$	4 pts to here
$5x = 4x - 24$	5 pts to here
$x = -24$	6 pts to here

15. Solve for a.

$$\frac{a+2}{3a+1} = \frac{1}{2}$$

$2(a+2) = 3a+1$	3 pts to here
$2a+4 = 3a+1$	4 pts to here
$a = 3$	6 pts to here

16. A 4-gallon can of paint covers 240 square feet. How many gallons of paint do you need to cover 360 square feet?

$\frac{4}{240} = \frac{x}{360}$	4 pts to here
$4 \cdot 360 = 240x$	6 pts to here
$x = 6 gallons$	8 pts to here

17. On a map the distance between two mountains is $3\frac{1}{2}$ inches. The actual distance is 136 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.

$\frac{3.5in}{136miles} = \frac{.75in}{xmiles}$	4 pts to here
$3.5x = (.75)(136)$	6 pts to here
$x = 29.1$	7 pts to here
$x = 29.1 miles$	8 pts to here

18. Simplify.

$(-4x^{\frac{1}{8}}y^{\frac{1}{2}})(2x^{\frac{3}{4}}y^{\frac{1}{3}})$

$-8x^{\frac{1}{8}+\frac{3}{4}}y^{\frac{1}{2}+\frac{1}{3}}$	3 pts to here
$-8x^{\frac{7}{8}}y^{\frac{5}{6}}$	6 pts to here

19. Simplify.

$\sqrt[3]{64a^{12}b^{30}}$

$4a^4b^{10}$	6 pts

20. Simplify.

$4\sqrt{50x} + 3\sqrt{2x} + \sqrt{72x}$

$20\sqrt{2x} + 3\sqrt{2x} + \sqrt{72x}$	2 pts to here
$20\sqrt{2x} + 3\sqrt{2x} + 6\sqrt{2x}$	4 pts to here
$29\sqrt{2x}$	6 pts to here