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 114 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.

   $16x^3y - 24x^2y + 9xy$

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.

   $$\frac{x^2 + 9x + 20}{2x^2 + 7x - 15}$$

8. Simplify.

   $$\frac{2x^2 - 7x - 4}{16 - x^2}$$

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.
$$\frac{3x}{x^2 - 49} - \frac{2}{x + 7}$$

12. Add.
$$\frac{4}{x^2 + 11x + 28} + \frac{5}{x^2 + 9x + 14}$$

13. Simplify.
$$\frac{\frac{15}{x^2-36}}{\frac{5}{x+6} + \frac{5}{x-6}}$$

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

15. Solve for a.
$$\frac{a+3}{4a-3} = \frac{2}{3}$$

16. A 5-gallon can of paint covers 300 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 $7\frac{1}{2}$ 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.

18. Simplify.

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

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.

   $16x^3y - 24x^2y + 9xy$

$xy(16x^2 - 24x + 9)$	2 pts to here
$xy(4x - 3)^2$	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.

$$\frac{x^2 + 9x + 20}{2x^2 + 7x - 15}$$

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

8. Simplify.

$$\frac{2x^2 - 7x - 4}{16 - x^2}$$

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

$$\frac{3x}{x^2 - 49} - \frac{2}{x + 7}$$

Factoring of equivalent of one rational expression	2 pt
$\dfrac{3x}{(x+7)(x-7)} - \dfrac{2(x-7)}{(x+7)(x-7)}$	3 pts to here
$\dfrac{3x-2x+14}{(x+7)(x-7)}$	5 pts to here
(4 pts if $3x - 2x - 14$)	
$\dfrac{x+14}{(x+7)(x-7)}$	6 pts to here
5 pts if $\dfrac{x-14}{(x+7)(x-7)}$	

12. Add.

$$\frac{4}{x^2 + 11x + 28} + \frac{5}{x^2 + 9x + 14}$$

$\dfrac{4}{(x+4)(x+7)} + \dfrac{5}{(x+7)(x+2)}$	2 pts to here
$\dfrac{4(x+2)}{(x+4)(x+7)(x+2)} + \dfrac{5(x+4)}{(x+7)(x+2)(x+4)}$	3 pts to here
$\dfrac{4x+8+5x+20}{(x+4)(x+7)(x+2)}$	5 pts to here
$\dfrac{9x+28}{(x+4)(x+7)(x+2)}$	6 pts to here

13. Simplify.

$$\frac{\frac{15}{x^2-36}}{\frac{5}{x+6} + \frac{5}{x-6}}$$

Method 1	
$\dfrac{\frac{15}{x^2-36}}{\frac{5(x-6)}{(x+6)(x-6)}} + \dfrac{5(x+6)}{(x+6)(x-6)}$	2 pts to here
$\dfrac{\frac{15}{x^2-36}}{\frac{10x}{(x+6)(x-6)}}$	3 pts to here
$\dfrac{15}{(x+6)(x-6)} \times \dfrac{(x+6)(x-6)}{10x}$	4 pts to here
$\dfrac{15}{10x}$	5 pts to here
$\dfrac{3}{2x}$	6 pts to here
Method 2	
$\dfrac{(x+6)(x-6)}{(x+6)(x-6)} \times \dfrac{\frac{15}{x^2-36}}{\frac{5}{x+6}+\frac{5}{x-6}}$	2 pts to here
$\dfrac{15}{5(x-6)+5(x+6)}$	4 pts to here
$\dfrac{15}{10x}$	5 pts to here
$\dfrac{3}{2x}$	6 pts to here

14. Solve for x.

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

$(x+2)(x-2)\dfrac{5x}{(x+2)(x-2)} = \dfrac{(x+2)(x-2)8}{x+2} - \dfrac{(x+2)(x-2)4}{x-2}$	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.

$$\frac{a+3}{4a-3} = \frac{2}{3}$$

$3(a+3) = 2(4a-3)$	3 pts to here
$3a + 9 = 8a - 6$	4 pts to here
$5a = 15$	5 pts to here
$a = 3$	6 pts to here

16. A 5-gallon can of paint covers 300 square feet. How many gallons of paint do you need to cover 360 square feet?

$\dfrac{5}{300} = \dfrac{x}{360}$	4 pts to here
$5 \cdot 360 = 300x$	6 pts to here
$x = 6 gallons$	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.

$\dfrac{7.5in}{148miles} = \dfrac{.75in}{xmiles}$	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

18. Simplify.

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

$-6x^{\frac{1}{4}+\frac{1}{3}}y^{\frac{1}{2}+\frac{1}{3}}$	3 pts to here
$-6x^{\frac{7}{12}}y^{\frac{5}{6}}$	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