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.
   $21a^2b - 14ab^2$

2. Factor completely.
   $x^2 - 3x - 28$

3. Factor completely.
   $9x^2 - 13x + 4$

4. Factor completely.
   $64a^2 - 25$

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.

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

8. Simplify.

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

9. Multiply.
$$\frac{x^2-2x-35}{6x+30} \times \frac{5x+5}{x^2-5x-14}$$

10. Divide.
$$\frac{x^2-9x+18}{x^2+9x-22} \div \frac{x^2-4x-12}{x^2+13x+22}$$

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

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

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

14. Solve for x.
$$\frac{2x}{x^2-1}=\frac{3}{x+1}-\frac{2}{x-1}$$

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

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 $7\frac{1}{2}$ 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.
$(-4x^{\frac{2}{3}}y^{\frac{1}{4}})(3x^{\frac{1}{6}}y^{\frac{1}{2}})$

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

20. Simplify.
$3\sqrt{12x}+5\sqrt{3x}+\sqrt{75x}$

Solutions

1. Factor completely.

   $21a^2b - 14ab^2$

$7ab$	2 pts to here
$7ab(3a - 2b)$	4 pts to here
Award 3 points if the correct GCF is found, but there is a minor mistake in factoring.	

2. Factor completely.

   $x^2 - 3x - 28$

$(x - 7)(x + 4)$	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.

   $64a^2 - 25$

$(8a - 5)(8a + 5)$	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.

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

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.

$$\frac{x^2 - 2x - 35}{6x + 30} \times \frac{5x + 5}{x^2 - 5x - 14}$$

Factoring of equivalent of one rational expression	2 pt
$\frac{(x-7)(x+5)}{6(x+5)} \times \frac{5(x+1)}{(x-7)(x+2)}$	4 pts to here
$\frac{5(x+1)}{6(x+2)}$	6 pts to here

10. Divide.

$$\frac{x^2 - 9x + 18}{x^2 + 9x - 22} \div \frac{x^2 - 4x - 12}{x^2 + 13x + 22}$$

Factoring of equivalent of one rational expression	2 pt
$\frac{(x-3)(x-6)}{(x+11)(x-2)} \times \frac{(x+11)(x+2)}{(x-6)(x+2)}$	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
$\frac{3x}{(x+7)(x-7)}-\frac{2(x-7)}{(x+7)(x-7)}$	3 pts to here
$\frac{3x-2x+14}{(x+7)(x-7)}$	5 pts to here
(4 pts if $3x-2x-14$)	
$\frac{x+14}{(x+7)(x-7)}$	6 pts to here
5 pts if $\frac{x-14}{(x+7)(x-7)}$	

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.

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

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

14. Solve for x.

$$\frac{2x}{x^2-1}=\frac{3}{x+1}-\frac{2}{x-1}$$

$(x+1)(x-1)\frac{2x}{(x+1)(x-1)} = \frac{(x+1)(x-1)3}{x+1} - \frac{(x+1)(x-1)2}{x-1}$	2 pts to here
$2x = 3(x-1) - 2(x+1)$	3 pts to here
$2x = 3x - 3 - 2x - 2$	4 pts to here
$2x = x - 5$	5 pts to here
$x = -5$	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 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 $7\frac{1}{2}$ 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

18. Simplify.

$(-4x^{\frac{2}{3}}y^{\frac{1}{4}})(3x^{\frac{1}{6}}y^{\frac{1}{2}})$

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

19. Simplify.

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

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

20. Simplify.

$3\sqrt{12x} + 5\sqrt{3x} + \sqrt{75x}$

$6\sqrt{3x}+5\sqrt{3x}+\sqrt{75x}$	2 pts to here
$6\sqrt{3x}+5\sqrt{3x}+5\sqrt{3x}$	4 pts to here
$16\sqrt{3x}$	6 pts to here