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 2 hours.

- There are 23 problems which appear on the fronts and backs of the pages of this exam.

- You may earn a total of 100 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.

- Calculators are allowed.

1. [4 points] Factor $w^2 - 7x + 10$.

2. [4 points] Factor $ax^2 - bx^2 - 9a + 9b$.

3. [4 points] Simplify $\dfrac{t^2 + 9t + 14}{2t^2 - 6t - 20}$.

4. [4 points] Simplify $\dfrac{9x^2}{4x - 4} \div \dfrac{18x}{(x-1)(x+1)}$.

5. [4 points] Simplify $\dfrac{2n}{n^2 - 16} - \dfrac{5}{n + 4}$

6. [4 points] Simplify $\dfrac{2x + 5}{x^2 + 6x + 5} + \dfrac{-x + 3}{2x + 10}$.

7. [4 points] Simplify $\dfrac{\dfrac{5}{x}}{\dfrac{6}{x} + \dfrac{4}{x^2}}$.

8. [4 points] Solve $\dfrac{5}{4} = \dfrac{4x + 5}{x + 10} + 6$.

9. [4 points] A contractor estimated that 15 square feet of window space will be allowed for every 160 square feet of floor space. Using this estimate, how much window space will be allowed for 3200 square feet of floor space?

10. [4 points] Combine. Assume that all variables represent nonnegative real numbers. $\sqrt{108x} - 2\sqrt{18x} - \sqrt{48x}$.

11. [4 points] At 5 p.m., Coretta's shadow is 2.33 meters long. Her height is 1.81 meters. At the same time, a tree's shadow is 5.84 meters long. How tall is the tree?

12. [4 points] Solve $\sqrt{4x - 36} - 2 = 2$.

13. [4 points] Simplify $5 - \sqrt{-18}$.

14. [4 points] The volume of jet fuel used at cruising altitude by an MD80 passenger jet is directly proportional to time in flight. In flying at cruising altitude for 36 minutes, an MD80 uses 388 gallons of jet fuel.

   (a) Write an equation relating the amount of jet fuel used at cruising altitude to time at cruising altitude.

   (b) Find the amount of jet fuel used by flying at cruising altitude for 90 minutes.

15. [4 points] If temperature remains constant, the volume of gas varies inversely as the pressure of the gas on its container. A pressure of 60 pounds per square inch corresponds to a volume of 45 cubic inches.

   (a) Write an equation relating pressure to volume.

   (b) What pressure corresponds to a volume of 70 cubic inches?

16. [4 points] Solve by using the square root property. $(2x - 10)^2 = 7$.

17. [4 points] The Wollombi Falls in Australia have a height of 1100 feet. A pebble is thrown upward from the top of the falls with an initial velocity of 30 feet per second. The height of the pebble after t seconds is given by the equation $h = 16t^2 + 30t + 1100$. How long after the pebble is thrown will it be 550 feet from the ground? Round to the nearest tenth of a second.

18. [8 points] Tanya runs diagonally across a rectangular field, from corner to corner. The total distance she ran was 40 yards. If one side of the rectangular field is 24 yards, what is the length of the other side of the field? Keep answers in simplified radical form.

19. [4 points] Graph the quadratic function with the characteristics below. Be sure to label the appropriate points on the graph.

- Vertex: $(-5, -1)$
- y-intercept: $y = 5.25$
- x-intercepts: $x = -3, -75$
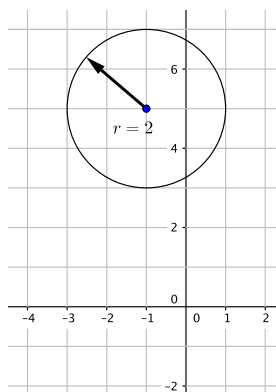- Axis of symmetry: $x = -5$
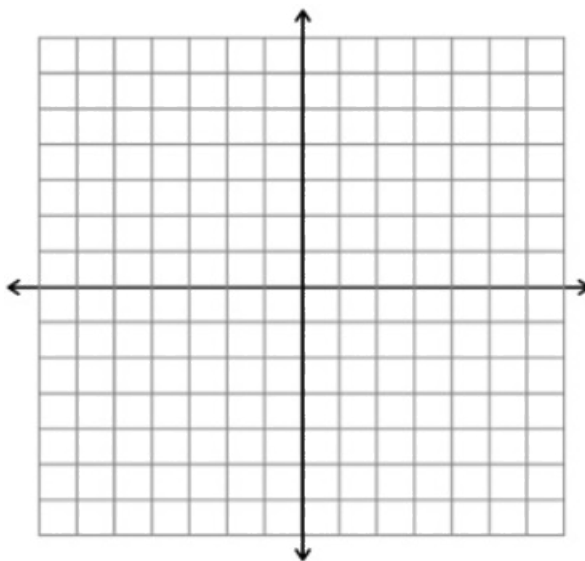
20. [4 points] Solve $|7x + 1| \geq 3$ and graph the solution on the number line below.
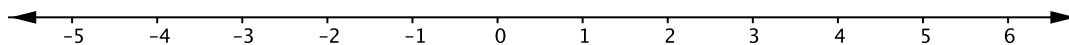
21. [4 points] Find the distance between $(7, 3)$ and $(1, 10)$.

22. [4 points] Find the equation of the circle graphed below.

23. [4 points] Each table below contains some data pertaining to a function. Identify the domain and range for each.

(a) Players on SCSU's Women's Soccer Team:

Jersey Number	1	8	9	16
Birth Year	1997	1998	1996	1997

(b) Weight of a Person Each Monday in May:

Weight (in pounds)	162	160	162	158
Week Number	1	2	3	4

24. [4 points] Let $h(t) = 2t^2 - 8t - 1$. Find $h(2)$ and $h(-3)$. Be sure to simplify your answers.

Solutions

1. Factor $w^2 - 7x + 10$.

$w^2 - 2w - 5w + 10$	2 pts to here
$w(w - 2) - 5(w - 2)$	3 pts to here
$(w - 2)(w - 5)$	4 pts to here

2. Factor $ax^2 - bx^2 - 9a + 9b$.

$x^2(a - b) - 9(a - b)$	2 pts to here
$(x^2 - 9)(a - b)$	3 pts to here
$(x - 3)(x + 3)(a - b)$	4 pts to here

3. Simplify $\dfrac{t^2 + 9t + 14}{2t^2 - 6t - 20}$.

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

4. Simplify $\dfrac{9x^2}{4x - 4} \div \dfrac{18x}{(x - 1)(x + 1)}$.

$\dfrac{9x^2}{4(x-1)} \div \dfrac{18x}{(x-1)(x+1)}$	1 pt
$\dfrac{9x^2}{4(x-1)} \times \dfrac{18x}{(x-1)(x+1)}$	2 pts to here
$\dfrac{x^2(x+1)}{8x}$	4 pts to here

5. Simplify $\dfrac{2n}{n^2 - 16} - \dfrac{5}{n + 4}$

$\dfrac{2n}{(n-4)(n+4)} - \dfrac{5}{(n+4)}$	1 pts to here
$\dfrac{2n}{(n-4)(n+4)} - \dfrac{5(n-4)}{(n-4)(n+4)}$	2 pts to here
$\dfrac{2n - 5n + 20)}{(n-5)(n+5)}$	3 pts to here
$\dfrac{-n + 20}{(n-4)(n+4)}$	4 pts to here

6. Simplify $\dfrac{2x + 5}{x^2 + 6x + 5} + \dfrac{-x + 3}{2x + 10}$.

$\dfrac{(2x+5)}{(x+5)(x+1)} + \dfrac{(-x+3)}{2(x+5)}$	1 pt
$\dfrac{2(2x+5)}{2(x+5)(x+1)} + \dfrac{(-x+3)(x+1)}{2(x+5)(x+1)}$	2 pt
$\dfrac{4x+10-x^2+2x+3}{2(x+5)(x+1}$	3 pts to here
$\dfrac{-x^2+6x+13}{2(x+5)(x+1)}$	4 pts to here

7. Simplify $\dfrac{\dfrac{5}{x}}{\dfrac{6}{x} + \dfrac{4}{x^2}}$.

Method 1	
$\dfrac{x^2}{x^2}\left(\dfrac{\dfrac{5}{x}}{\dfrac{6}{x} + \dfrac{4}{x^2}}\right)$	2 pts to here
$\dfrac{5x}{6x + 4}$	4 pts to here
Method 2	
$\dfrac{\dfrac{5}{x}}{\dfrac{6x}{x^2} + \dfrac{4}{x^2}}$	1 pt to here
$\dfrac{\dfrac{5}{x}}{\dfrac{6x + 4}{x^2}}$	2 pts to here
$\dfrac{5}{x} \times \dfrac{x^2}{6x + 4}$	3 pts to here
$\dfrac{5x}{6x + 4}$	4 pts to here

8. Solve $\dfrac{5}{4} = \dfrac{4x + 5}{x + 10} + 6$.

$5(x + 10) = 4(4x + 5) + 4(6)(x + 10)$	1 pts to here
$5x + 50 = 16x + 20 + 24x + 240$	2 pts to here
$5x + 50 = 40x + 260$	3 pts to here
$-6 = x$	4 pts to here

9. A contractor estimated that 15 square feet of window space will be allowed for every 160 square feet of floor space. Using this estimate, how much window space will be allowed for 3200 square feet of floor space?

$\dfrac{x}{3200} = \dfrac{15}{160}$ or	
$\dfrac{x}{15} = \dfrac{3200}{160}$ or	
$\dfrac{15}{160} = \dfrac{x}{3200}$	2 pts to here
$160x = 48000$	3 pts to here
$x = 300$ square feet	4 pts to here
(3 pts for correct solution, but no units are given)	

10. Combine. Assume that all variables represent nonnegative real numbers. $\sqrt{108x} - 2\sqrt{18x} - \sqrt{48x}$.

$6\sqrt{3x} - 6\sqrt{2x} - 4\sqrt{3x}$	2 pts to here
$2\sqrt{3x} - 6\sqrt{2x}$	4 pts to here

11. At 5 p.m., Coretta's shadow is 2.33 meters long. Her height is 1.81 meters. At the same time, a tree's shadow is 5.84 meters long. How tall is the tree?

> $\dfrac{x}{5.84} = \dfrac{1.81}{2.33}$ or $\dfrac{1.81}{x} = \dfrac{2.33}{5.84}$ or other correct proportions   (3 pts to here)
> correct denominator elimination   (4 pts to here)
> $x = 4.54$ (5 pts to here)
> The tree is 4.54 meters tall.   (6 pts to here)

12. Solve $\sqrt{4x - 36} - 2 = 2$.

> $\sqrt{4x - 36} = 4$ 1 pt to here
> $4x - 36 = 16$ 2 pts to here
> $4x = 52$ 3 pts to here
> $x = 13$ 4 pts to here

13. Simplify $5 - \sqrt{-18}$.

> $5 - \sqrt{-1}\sqrt{18}$ 1 pts to here
> $5 - 3\sqrt{-1}\sqrt{2}$ 2 pts to here or
> $5 - i\sqrt{18}$ 3 pts to here
> $5 - 3i\sqrt{2}$ 4 pts to here

14. The volume of jet fuel used at cruising altitude by an MD80 passenger jet is directly proportional to time in flight. In flying at cruising altitude for 36 minutes, an MD80 uses 388 gallons of jet fuel.

    (a) Write an equation relating the amount of jet fuel used at cruising altitude to time at cruising altitude.

    (b) Find the amount of jet fuel used by flying at cruising altitude for 90 minutes.

> (a) $V = kt$ 1 pt to here
> (a) $V = \frac{388}{36}t$ or $V = \frac{97}{9}t$ 2 pts to here
> (b) $V = \frac{97}{9}90$ or $V = 970$ 3 pts to here
> (b) 970 gallons   4 pts to here

15. If temperature remains constant, the volume of gas varies inversely as the pressure of the gas on its container. A pressure of 60 pounds per square inch corresponds to a volume of 45 cubic inches.

    (a) Write an equation relating pressure to volume.

    (b) What pressure corresponds to a volume of 70 cubic inches?

> (a) $V = \frac{k}{P}$ (or other variables)   1 pt to here
> (a) $V = \frac{2700}{P}$ 2 pts to here
> (b) $V = \frac{2700}{100}$ or $C = 27$ 3 pts to here
> (b) 27 pounds per square inch   4 pts to here

16. Solve by using the square root property. $(2x - 10)^2 = 7$.

$2x - 10 = \pm\sqrt{7}$	1 pt to here
$2x = 10 + \sqrt{7}$	
$x = \dfrac{10 + \sqrt{7}}{2}$	2 pts to here
$2x = 10 - \sqrt{7}$	3 pts to here
$x = \dfrac{10 - \sqrt{7}}{2}$	4 pts

17. The Wollombi Falls in Australia have a height of 1100 feet. A pebble is thrown upward from the top of the falls with an initial velocity of 30 feet per second. The height of the pebble after t seconds is given by the equation $h = 16t^2 + 30t + 1100$. How long after the pebble is thrown will it be 550 feet from the ground? Round to the nearest tenth of a second.

$550 = -16t^2 + 30t + 1100$ or $0 = -16t^2 + 30t + 550$	1 pt to here
$t = \frac{-30 \pm \sqrt{30^2 - 4(-16)(550)}}{2(-16)}$	2 pt to here
$t = 6.875$	3 pts to here
6.9 seconds	4 pts to here

18. Tanya runs diagonally across a rectangular field, from corner to corner. The total distance she ran was 40 yards. If one side of the rectangular field is 24 yards, what is the length of the other side of the field? Keep answers in simplified radical form.

|	
$24^2 + x^2 = 40^2$	1 pt to here
$x^2 = 224$	2 pts to here
$x = \sqrt{224}$ or $x = \pm\sqrt{224}$	3 pts to here
$x = 4\sqrt{14}$ yards	4 pts to here (3 pts no units)

19. Graph the quadratic function with the characteristics below. Be sure to label the appropriate points on the graph.

   - Vertex: $(-5, -1)$

   - y-intercept: $y = 5.25$

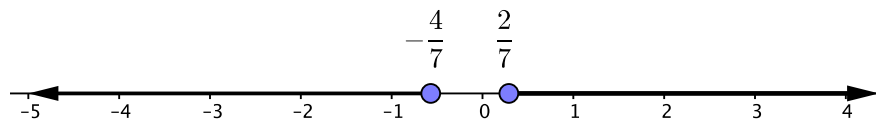   - x-intercepts: $x = -3, -75$

   - Axis of symmetry: $x = -5$
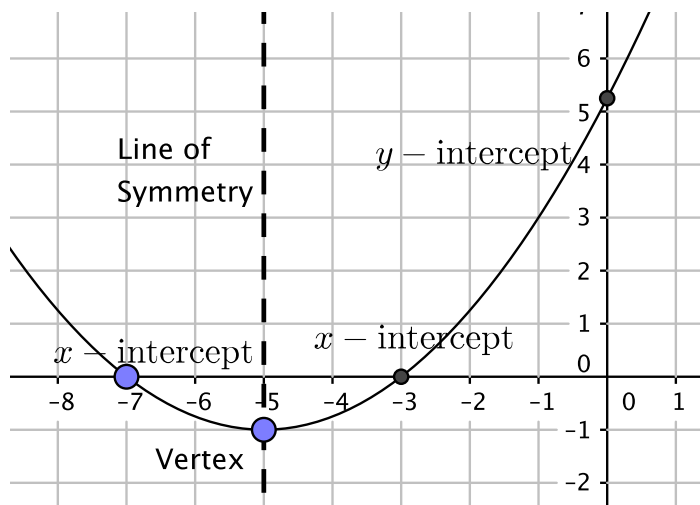
Plot the vertex correct	1 point
Plot the x-intercepts	Add 2 pts
Plot the y-intercept	Add 1 pt
Have a concave down parabola	Add 2 pts
Label the points	Add 2 pts

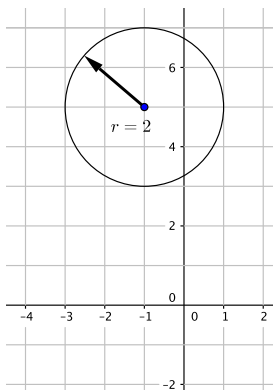20. Solve $|7x + 1| \geq 3$ and graph the solution on the number line below.
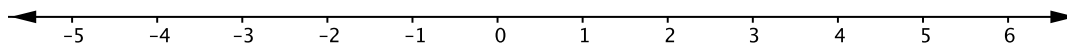
$7x + 1 \geq 3$ or $7x + 1 \leq -3$	2 pts
$x \geq \dfrac{2}{7}$ or $x \leq -\dfrac{4}{7}$	1 pt
Graphing the solution correctly	1 pt

21. Find the distance between $(7, 3)$ and $(1, 10)$.

$d = \sqrt{(1 - 7)^2 + (10 - 3)^2}$	1 pt to here
$d = \sqrt{(-6)^2 + (7)^2}$	2 pts to here
$d = \sqrt{36 + 49}$	3 pts to here
$d = \sqrt{85}$	4 pts to here

22. Find the equation of the circle graphed below.

Correct form of the equations	$(x - h)^2 + (y - k)^2 = r^2$	Add 2 points
Correct center of the circle	$(-1, 5)$	Add 1 point
Correct radius of the equation	$r = 2$	Add 1 point

23. Each table below contains some data pertaining to a function. Identify the domain and range for each.

    (a) Players on SCSU's Women's Soccer Team:

Jersey Number	1	8	9	16
Birth Year	1997	1998	1996	1997

    (b) Weight of a Person Each Monday in May:

Weight (in pounds)	162	160	162	158
Week Number	1	2	3	4

(a)	Domain: Jersey Number or $\{1, 8, 9, 16\}$	Add 1 point
	Range: Birth Year or $\{1996, 1997, 1998\}$	Add 1 point
(b)	Domain: Week Number or $\{1, 2, 3, 4\}$	Add 1 point
	Range: Weight or $\{158, 160, 162\}$	Add 1 point

24. Let $h(t) = 2t^2 - 8t - 1$. Find $h(2)$ and $h(-3)$. Be sure to simplify your answers.

$h(2) = -9$	2 pts
$h(-3) = 2(-3)^2 - 8(-3) - 1$	1 additional point
$h(-3) = 35$	1 additional point