Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page. Circle or box your answers. Show all work and check your answers.

Name: ______________________________

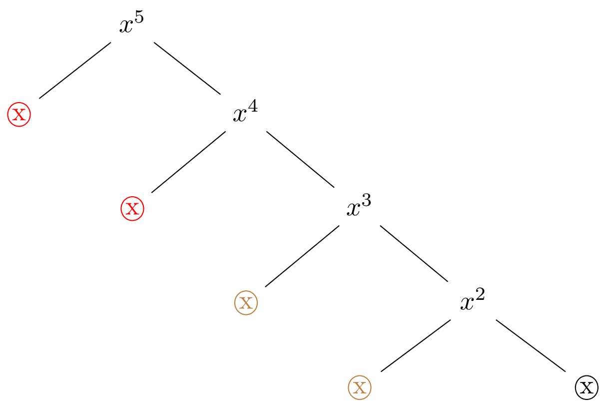
ID number: ______________________________

Question	Points	Score
1	4	
2	4	
3	4	
4	4	
5	4	
6	4	
7	4	
8	4	
9	4	
10	4	
11	4	
12	4	
13	4	
14	4	
15	4	
16	6	
17	6	
18	6	
19	6	
20	6	
21	6	
22	6	
Total:	102	

1. (4 points) Simplify:

$$\sqrt{\frac{x^5}{9}}$$

Solution:



This gives: $\boxed{\dfrac{x^2\sqrt{x}}{3}}$.

2. (4 points) Factor completely: $x^3 + 216$

Solution: I use the Difference of Cubes method and use SOAP. This gives $(x+6)(x^2-6x+36)$. I check to see if $(x^2-6x+36)$ can be factored. The quadratic formula gives

$$x = \frac{6 \pm \sqrt{36 - 4(36)}}{2}$$

Under the square root is a negative number, so $x^2-6x+36$ cannot be factored further. This means my final answer is $\boxed{(x+6)(x^2-6x+36)}$.

3. (4 points) Solve for x:

$$y = \frac{4x-9}{3} + B$$

Solution:

$$\begin{aligned}
y - B &= \frac{4x-9}{3} \\
3(y-B) &= 4x - 9 \\
3(y-B) + 9 &= 4x \\
\boxed{\frac{3(y-B)+9}{4} = x}
\end{aligned}$$

4. (4 points) Find the complete solution set and write your answer in both interval notation and inequality notation: $4 - 5x \leq 49$

Solution:

$$\begin{aligned}
-5x &\leq 45 \\
\underline{x \geq -9}
\end{aligned}$$

I check a value in this range. I choose 0:

$$\begin{aligned}
4 - 5(0) &\leq 49 \\
4 &\leq 49
\end{aligned}$$

This value works so my answer is $\boxed{x \geq -9}$. I can write this in inequality notation as $\boxed{[-9, \infty)}$.

5. (4 points) Find the complete solution set and write your answer in both interval notation and inequality notation $2 < 3 - \frac{x}{2} \leq 27$

Solution:

$$\begin{aligned}
-1 < -\frac{x}{2} &\leq 27 \\
\underline{2 > x \geq -54}
\end{aligned}$$

I check a value in this range. I choose 0:

$$\begin{aligned}
2 < 3 - \frac{0}{2} &\leq 27 \\
2 < 3 &\leq 27
\end{aligned}$$

This works, so my final answer is $\boxed{2 > x \geq -54}$. I can write this in interval notation as $\boxed{[-54, 2)}$.

6. (4 points) Find the distance between $(7, 4)$ and $(11, 7)$

Solution: I use the Distance Formula with $x_1 = 7$, $y_1 = 4$, $x_2 = 11$, and $y_2 = 7$.

$$d = \sqrt{(11-7)^2 + (7-4)^2}$$
$$d = \sqrt{4^2 + 3^2}$$
$$d = \sqrt{16+9}$$
$$d = \sqrt{25}$$
$$\boxed{d = 5}$$

7. (4 points) Find the midpoint between $(2a, 10)$ and $(6a, 8)$.

Solution: I use the Midpoint Formula with $x_1 = 2a$, $y_1 = 10$, $x_2 = 6a$, and $y_2 = 8$. This gives:

$$\begin{aligned}(x,y) &= \left(\frac{2a+6a}{2}, \frac{10+8}{2}\right)\\ &= \left(\frac{8a}{2}, \frac{18}{2}\right)\\ &= \boxed{(4a, 9)}\end{aligned}$$

8. (4 points) If a line AB has endpoint $A = (2, 1)$ and midpoint $M = (12, 3)$, find B.

Solution: I set up two equations using the Midpoint Formula:

$$\frac{2+x_2}{2} = 12 \qquad \frac{1+y_2}{2} = 3$$
$$2 + x_2 = 24 \qquad 1 + y_2 = 6$$
$$x_2 = 22 \qquad y_2 = 5$$

This gives $\boxed{B = (22, 5)}$.

9. (4 points) What is the x-intercept(s) of the following graph:

x :	1	9	0	3	4
y :	5	0	8	3	2

Solution: The x-intercept(s) are the values when $y = 0$. For this graph, the only x-intercept is at $\boxed{(9, 0)}$.

10. (4 points) Find the y-intercepts of:

$$4y^2 - 12x^2 = 36$$

Solution: To find the y-intercepts I plug in $x = 0$ and get

$$\begin{aligned} &4y^2 - 12(0)^2 = 36 \\ &4y^2 = 36 \\ &y^2 = 9 \\ &y = 3 \text{ and } y = -3 \end{aligned}$$

Thus my y-intercepts are $\boxed{(0, 3) \text{ and } (0, -3)}$.

11. (4 points) Find the horizontal line that goes through the point $(33, 27)$

Solution: Points on a horizontal line all have the same y-value. Thus the line is $\boxed{y = 27}$.

12. (4 points) Is the following relation a function? If no, state why.

x :	0	1	2	3	4	5
y :	1	2	3	4	3	5

Solution: There are no two x-values in common, so $\boxed{yes}$ this is a function.

13. (4 points) Is the following relation a function? If no, state why.

x :	1	2	3	4	3	5
y :	0	1	2	3	4	5

Solution: There are two values of 3 that have different outputs so $\boxed{no}$ this is not a function.

14. (4 points) Find the range of $y = x^2 + 21$

Solution: The range of $y = x^2$ is $y \geq 0$ so the range of $y = x^2 + 21$ is $\boxed{y \geq 21}$.

15. (4 points) Find the domain of

$$y = \frac{7}{x^2 + x - 30}$$

Solution: I factor the bottom and get

$$y = \frac{7}{(x+6)(x-5)}$$

so the denominator equals 0 when $x = -6$ or $x = 5$ so my domain is all $x \neq \{-6, 5\}$. I write this in interval notation by $\boxed{(-\infty, -6) \cup (-6, 5)\infty(5, \infty)}$.

16. (6 points) Simplify:

$$\left(\frac{2x^{-2}y^9}{3x^{-6}y^{-4}}\right)^6$$

Solution:

$$\begin{aligned}
&= \frac{2^6x^{-12}y^{54}}{3^6x^{-36}y^{-24}} \\
&= \frac{2^6y^{54}y^{24}x^{36}}{3^6x^{12}} \\
&= \boxed{\frac{64y^{78}x^{24}}{729}}
\end{aligned}$$

17. (6 points) Rationalize the denominator. (You do not need to simplify the numerator):

$$\frac{1+\sqrt{2}}{4-3\sqrt{7}}$$

Solution:

$$\begin{aligned}
&= \frac{1+\sqrt{2}}{4-3\sqrt{7}} \cdot \frac{4+3\sqrt{7}}{4+3\sqrt{7}} \\
&= \frac{(1+\sqrt{2})(4+3\sqrt{5})}{(4-3\sqrt{7})(4+3\sqrt{7})} \\
&= \frac{(1+\sqrt{2})(4+3\sqrt{5})}{16+12\sqrt{7}-12\sqrt{7}-9(7)} \\
&= \frac{(1+\sqrt{2})(4+3\sqrt{5})}{16-63} \\
&= \frac{(1+\sqrt{2})(4+3\sqrt{5})}{-47} \\
&= \boxed{-\frac{(1+\sqrt{2})(4+3\sqrt{5})}{47}}
\end{aligned}$$

18. (6 points) Factor completely:

$$9x^3 - 81x^2 - 4x + 36$$

Solution:

$$\begin{aligned} &= 9x^2(x-9) - 4(x-9) \\ &= (9x^2 - 4)(x-9) \\ &= \boxed{(3x-2)(3x+2)(x-9)} \end{aligned}$$

19. (6 points) Find the complete solution set:

$$\sqrt{5x-6} = x$$

Solution:

$$\begin{aligned} 5x - 6 &= x^2 \\ 0 &= x^2 - 5x + 6 \\ 0 &= (x-3)(x-2) \end{aligned}$$

Thus there are two possibilities, $\underline{x = 3}$ and $\underline{x = 2}$. I plug in both answers to the original equation

$$\begin{aligned} \sqrt{5(3) - 6} &= 3 \\ \sqrt{15 - 6} &= 3 \\ \sqrt{9} &= 3 \\ 3 &= 3 \end{aligned} \qquad \begin{aligned} \sqrt{5(2) - 6} &= 2 \\ \sqrt{10 - 6} &= 2 \\ \sqrt{4} &= 2 \\ 2 &= 2 \end{aligned}$$

Both solutions work so the answer is $\boxed{x = 2 \text{ and } x = 3}$.

20. (6 points) Find the complete solution set:

$$|5x+8| = x$$

Solution:

$$\begin{aligned} 5x+8 &= x \\ 4x &= -8 \\ \underline{x = -2} \end{aligned} \qquad \begin{aligned} -(5x+8) &= x \\ -5x-8 &= x \\ 6x &= -8 \\ \underline{x = -\frac{8}{6}} \end{aligned}$$

Now I plug both solutions in to check my answers:

$$\begin{aligned} |5(-2)+8| &= -2 \\ |-10+8| &= -2 \\ |-2| &= -2 \\ 2 &= -2 \end{aligned} \qquad \begin{aligned} |5(-\frac{8}{6})+8| &= -\frac{8}{6} \\ |\frac{-40}{6}+\frac{48}{6}| &= -\frac{8}{6} \\ |\frac{8}{6}| &= -\frac{8}{6} \\ \frac{8}{6} &= -\frac{8}{6} \end{aligned}$$

Neither solution works so the final answer is $\boxed{\text{no solution}}$.

21. (6 points) Find the center and radius of $x^2 - 12x + y^2 + 8y- = 0$

Solution: I need to complete the square:

$$\begin{aligned} x^2 - 12x + 36 + y^2 + 8y + 16 &= 29 + 36 + 16 \\ (x-6)^2 + (y+4)^2 &= 81 \end{aligned}$$

Now that I am in standard form for a circle I can read off my center to be $\boxed{(6,-4)}$ and my radius to be $\boxed{9}$.

22. (6 points) What (if any) are the symmetries of

$$9x^2y = 1$$

Solution: I first check for x-axis symmetry:

$$\begin{aligned} &9x^2(-y) = 1 \\ &-9x^2y = 1 \end{aligned}$$

This is not the original equation so $\boxed{\text{no this is not x-axis symmetry}}$. Now I check for y-axis symmetry:

$$\begin{aligned} &9(-x)^2y = 1 \\ &9x^2y = 1 \end{aligned}$$

This is my original equations so $\boxed{\text{yes, this is y-axis symmetric}}$. Lastly, I check for origin symmetry:

$$\begin{aligned} &9(-x)^2(-y) = 1 \\ &-9x^2y = 1 \end{aligned}$$

This is not my original equation, so $\boxed{\text{no this is not origin symmetric}}$.