Mathematics I **Worksheet 1** Name:

1. Express the interval in terms of inequalities, and then graph the interval.
   (a) $[2, 8)$
   (b) $[-6, -\frac{1}{2}]$

2. Graph the set.
   (a) $(-\infty, -4) \cup (4, \infty)$
   (b) $(-\infty, 6) \cap (2, 10)$

3. Solve $\dfrac{3x+1}{4x-2} = 5$.

4. Solve $x^2 + x - 6 = 0$.

5. Solve $|x - 5| < 2$.

6. Solve $|3x + 2| \geq 4$.

7. Solve $x^2 + x - 6 > 0$.

8. Solve $x^2 + 1 = 6x$ by completing the square.

9. Solve $2x^2 + 20x - 3 = 0$ by completing the square.

10. Solve $x^2 - x - 2 < 0$.

11. If $f(x) = 3x + 5$, then find $f\left(\frac{1-x}{x}\right)$.

12. Find the following without using your calculator:
    (a) $\sin(\pi/4)$

    (b) $\cos(\pi/4)$

    (c) $\tan(\pi/4)$

    (d) $\tan(\pi/3)$

(e) $\sec(\pi/3)$

(f) $\cos(\pi/6)$

(g) $\cot(\pi/6)$

(h) $\csc(\pi/6)$

13. Solve $\sqrt{3}\tan(x) = 1$ if $0 \leq x < 2\pi$.

14. Solve $2\cos(x)\sin(x) + \cos(x) = 0$ if $0 \leq x < 2\pi$.

15. Solve $2|3x - 15| < 6$.

16. Find the center and radius of the circle $3x^2 + 3y^2 + 9x - 18y + 2 = 0$

17. Is $f(x) = 2x + 3\sin x$ one-to-one? Explain.

18. Is $f(x) = x\lfloor x \rfloor$ one-to-one? Explain.

19. Is $f(x) = \frac{2^x - 1}{4^x + 1}$ one-to-one? Explain.

20. Find the equation of the line parallel to $2x - \frac{3}{5}y + 7 = 0$ passing through the point $(-3, 4)$.

21. Solve $2\cos(x)\sin(x) = -\sqrt{3}\cos(x)$ if $0 \leq x < 2\pi$.

22. Solve $x^2 - x - 2 < 0$.

23. Find the domain of following function.

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

24. If $A = \{0, 1, 4, 9\}$ and $f(x) = \sqrt{x}$, then what is $f(A)$?

25. Given the function $f(x) = \frac{a^x + a^{-x}}{2}$, where $a > 2$. Then $f(x+y) + f(x-y) =$? Show your work.

A) $2f(x)f(y)$

B) $f(x)f(y)$

C) $\frac{f(x)}{f(y)}$

D) None of these

26. What is the domain of $f(x) = \frac{\arcsin(3-x)}{\ln(|x|-2)}$?

27. What is the domain of $f(x) = \frac{\log_2(x+3)}{x^2+3x+2}$?

28. What is the domain of $f(x) = \sqrt{x^2 + \lfloor x \rfloor^2}$?

29. What is the domain of $f(x) = \frac{1}{\sqrt{4x - |x^2 - 10x + 9|}}$?

30. What is the range of $f(x) = \lfloor |\sin x| + |\cos x| \rfloor$?

31. What are the domain and the range of of $f(x) = \sqrt{\lfloor x \rfloor - \{x\}}$?

32. What is the range of $f(x) = \frac{e^x - e^{|x|}}{e^x + e^{|x|}}$?

33. Solve $\frac{2}{x} < 3$.

34. Solve $\frac{x-2}{x+2} > \frac{2x-3}{4x-1}$.

35. Solve $x > \sqrt{1-x}$.

36. Prove that $\sqrt{x^2 + 2x} - \sqrt{x^2 - 2x + 1} = \begin{cases} -2, & x < -1 \\ 2x, & -1 \le x \le 1 \\ 2, & x > 1 \end{cases}$

37. Solve $|x - 3| + |x - 2| = 1$

38. Solve $\dfrac{|x+3|+x}{x+2} > 1$

39. Solve $\dfrac{-1}{|x|-2} \geq 1$

40. Find the domain and range of the function $f(x) = \sqrt{2x-3}$.

41. Find the domain and range of the function $f(x) = x^2 + 3$.

42. Find the domain and range of the function $f(x) = \frac{1}{x-2}$.

43. Find the domain and range of the function $f(x) = \frac{1}{x^2+2}$.

44. Let $f : \mathbb{R} \to \mathbb{R}$ where $f(x) = \dfrac{x^2+4x+7}{x^2+x+1}$. Is $f(x)$ one to one?

45. Find the domain and the range of the function $f(x) = \arcsin \dfrac{x^2}{2}$.

46. Find the domain of the function $f(x) = \frac{1}{\lfloor x \rfloor^2 - 7\lfloor x \rfloor - 8}$.

47. Find the domain of the function $f(x) = \sqrt{\lfloor x \rfloor - 1} + \sqrt{4 - \lfloor x \rfloor}$.

48. Write the piecewise definition of $f(x) = \sqrt{\lfloor x \rfloor}$.

49. Solve $2\lfloor x \rfloor = x + \{x\}$.

50. Verify that $x\text{sgn}(x) = |x|$.

51. Verify that $|x|\text{sgn}(x) = x$.

52. Verify that $x(\text{sgn}(x))(\text{sgn}(x)) = x$.

53. For $f(x) = \text{sgn}(\ln x)$ write the piecewise definition and draw the graph.

54. For $f(x) = \operatorname{sgn}(\sin x)$ write the piecewise definition and draw the graph.

55. Which of the following functions is (are) even, odd, or neither?

A) $f(x) = x^2 \sin x$

B) $f(x) = \sqrt{1 + x + x^2} - \sqrt{1 - x + x^2}$

C) $f(x) = \ln\left(\frac{1-x}{1+x}\right)$

D) $f(x) = \sin x - \cos x$

E) $f(x) = \frac{e^x + e^{-x}}{2}$