ILLAWARRA TUTORING

In this worksheet you will learn to work with absolute value functions and understand how their graphs are formed.

Easy Questions

1. Draw the graph of $y = |x|$ on a set of axes. Label the vertex and state the domain and range of the function.
2. Calculate the following:
$$|3|, \quad |-3|, \quad |0|\,.$$
3. Plot $y = |x - 3|$ on a set of axes and identify the coordinates of its vertex.
4. Solve the equation $|x| = 5$ and list all solutions.
5. Draw the graph of $y = |x| + 2$. Label the vertex and state the new range.

Intermediate Questions

6. Solve the equation $|x - 2| = 4$.
7. Solve the inequality $|x| < 3$, and represent your answer on a number line.
8. Write $|x - 1|$ as a piecewise function.
9. Describe in words the transformation that converts $y = |x|$ to $y = 2|x| + 1$. Specify the effect on the graph.
10. Evaluate $|-7|$.
11. For the function $y = |x| + 2$, determine its range.
12. Determine the domain and range of $y = |x| - 1$.
13. For $y = |x + 2|$, identify its line of symmetry.
14. Draw the graph of $y = |x| - 3$. Indicate the vertex on your graph.
15. For the function $f(x) = |x - 4|$, write its definition in piecewise form.
16. Solve the equation $|2x + 1| = 3$.
17. Solve the inequality $|x - 5| \geq 2$ and express your answer in interval notation.

18. State the vertex of $y = |x + 1|$.

19. Draw the graph of $y = |x| + 1$, labelling the vertex.

20. If $|x + a| = b$, express the solutions for x in terms of a and b, assuming $b \geq 0$.

Hard Questions

21. Solve the equation $|2x - 3| = |x + 1|$. Show all steps in your solution.

22. Find all solutions to $|x - 2| + 3 = 7$.

23. Solve the inequality $|3x - 1| < 5$. Represent your answer on a number line.

24. Find all solutions to $|x - 4| = |2x + 1|$. Justify your answer.

25. Prove that the vertex of $y = |x - h| + k$ is (h, k) and explain why $y = |x - h| + k$ attains its minimum value at this point.

26. Consider the equation $|x - 1| = |2x - 3|$. Solve the equation and discuss if any extraneous solutions arise.

27. Prove that the graph of $y = |x|$ is symmetric about the y-axis.

28. Determine all solutions for $|2x + 3| = 5 - x$. Explain any restrictions on x that must be considered.

29. For $y = |x - 5|$, find all values of x when $y = 3$. Describe geometrically what these solutions represent.

30. Given $f(x) = |x + 2| - |x - 3|$, find all x for which $f(x) = 0$. Provide a complete justification for your answer.