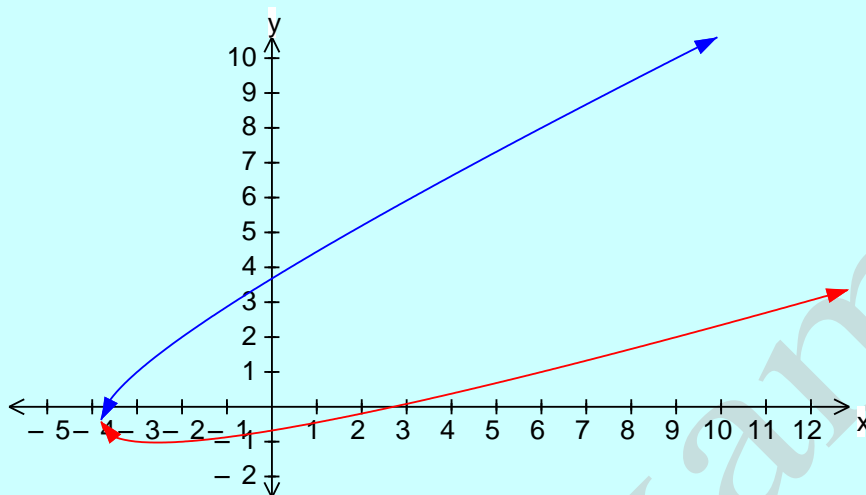


DIFFERENTIATION OF IMPLICIT RELATIONS

Due Date: _____

Objective: Use implicit differentiation to find the derivative of a relation and confirm by relating calculations to the graph.

The graph below shows the implicit relation $x^2 - 4xy + 4y^2 + x - 12y - 10 = 0$



1. Explain why this relation is not a function.
2. Confirm that the graph shows the given relation by calculating the values of y when $x = 6$, and showing that the corresponding points are on the graph.
3. Find the equation for y' by differentiating implicitly with respect to x . The answer will be in terms of x and y . Observe the product rule and the chain rule.
4. Use the equation from Question 3 to calculate the values of y' at the two points you found in Question 2. Show on the graph that the two answers are reasonable.
5. By rewriting the equation in the form $4y^2 - (4x+12)y + (x^2 + x - 10) = 0$ it is possible to find y in terms of x explicitly. Show that $y = \frac{1}{2}(x+3 \pm \sqrt{5x+19})$.
Hence explain why it is easier to find y' by implicit differentiation than it would be to find it directly from the explicit equation.
6. Find the equations of the tangents at the points where $x = 6$.
7. Find the equation of the tangent at the vertex of a parabola.
8. Draw the tangents lines on your graph.
9. Draw the graph of a relation and the three tangent lines on your calculator. Discuss any difficulties.