

**MCV 4U Handout**  
**Extra Practice with Implicit Differentiation**  
(Borrowed from an old text book, sorry for the bad formatting ☺)

### Practise

**A** 1. **Communication** a) Find the slope of the tangent to  $3x^2 - y^2 = 23$  at the point  $(4, 5)$  as follows:

- i) first solve for  $y$  explicitly as a function of  $x$ , then differentiate with respect to  $x$
- ii) use implicit differentiation to differentiate with respect to  $x$

b) Compare the two methods of differentiating in part a). Which method do you prefer?

Explain why.

2. Determine  $\frac{dy}{dx}$ .

- |                              |                              |
|------------------------------|------------------------------|
| a) $x^2 + y^2 = 25$          | b) $x^3 + x^2y + 4y^2 = 6$   |
| c) $x^3 + y^3 = 17$          | d) $4x^2 - y^2 = 36$         |
| e) $y^3 + y = 3x$            | f) $xy = 9$                  |
| g) $y^5 + x^2y^3 = 1 + x^4y$ | h) $\sqrt{x} + \sqrt{y} = 9$ |

3. Determine an equation of the tangent to the curve at the given point.

- |                                |                               |
|--------------------------------|-------------------------------|
| a) $x^2 + 9y^2 = 37, (1, 2)$   | b) $xy = 36, (9, 4)$          |
| c) $x^2y^2 + xy = 30, (-3, 2)$ | d) $y^4 + x^2y^3 = 5, (2, 1)$ |

### Apply, Solve, Communicate

**B** 4. i) Find the slope of the tangent to each curve at the given point.

ii) Find an equation of the tangent to each curve at the given point.

iii) Use graphing technology to illustrate your solution with a graph of the curve and the tangent at the given point.

- a)  $(x - 3)^2 + (y + 1)^2 = 16, (3, -5)$
- b)  $y^2 - 2xy = 11, (5, -1)$
- c)  $x^2 + y^2 - 4x + 6y = 87, (12, -3)$
- d)  $x^2 - xy + y^3 = 3, (-1, 1)$

5. **Application** a) Find an equation of the tangent to the circle  $x^2 + y^2 - 6x + 2y = 15$  at the point  $(6, 3)$ .

b) Sketch the circle and the tangent. Verify your result using technology.

6. **Application** a) Given a circle  $x^2 + y^2 + 4x - 12y = 60$  with centre  $C$ , show that

**11.** Find all points on the curve  $x^2y^2 + xy = 2$  where the slope of the tangent is  $-1$ .