

Worksheet 5b
[Differentiation and Applications]

1. Determine a point on the curve

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

at which the tangent line will have slope equal to 1.

2. Determine the equation to the tangent line of the curve

$$x^3 + y^3 = 9$$

at the point (2,1).

3. Given the curve

$$y(y^2 - 1)(y - 2) = x(x - 1)(x - 2)$$

- a. Determine the x-coordinates of the points on the curve where the tangent line is parallel to the x-axis.
b. Find the equation of the tangent line to the curve at (0,1) and at (0,2).

4. Show that the curves

$$x^2 - y^2 = 5 \quad \text{and} \quad 4x^2 + 9y^2 = 72$$

are orthogonal.

5. Show that

$$x^2 + y^2 = ax \quad \text{and} \quad x^2 + y^2 = by$$

are orthogonal families of curves.

6. Consider the curve

$$\sqrt{x} + \sqrt{y} = \sqrt{c}$$

Show that the sum of the x-and y-intercepts of any tangent line to the curve is equal to c.

7. Using implicit differentiation, show that the tangent to the ellipse, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

at the point (x_0, y_0)

is given by $\frac{x_0 x}{a^2} + \frac{y_0 y}{b^2} = 1$

5b.2

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Calculus 1

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8. Consider the curve $f(x) = x^{\frac{2}{3}}$.
Show that $f'(0)$ does not exist.
9. Show that $y = |4x - 1|$
is not differentiable at $\left(\frac{1}{4}, 0\right)$.