

Math Sheet

Name _____ Score _____ Teacher _____ Date _____

Implicit Differentiation

Find dy/dx for each implicit equation. Treat y as a function of x , and keep product and chain rule factors visible.

1. Find dy/dx .

$$5 \cdot x - 1 \cdot y = -12$$

Treat y as a function of x . Show product and chain rule work where needed.

2. Find dy/dx .

$$4 \cdot x^3 \cdot y - 2 \cdot x^3 = 48$$

Treat y as a function of x . Show product and chain rule work where needed.

Math Sheet

Name _____ Score _____ Teacher _____ Date _____

Implicit Differentiation

Find dy/dx for each implicit equation. Treat y as a function of x , and keep product and chain rule factors visible.

3. Find dy/dx .

$$-1 \cdot y - 3 \cdot (-1 \cdot x \cdot y - 1 \cdot x - 2)^2 = -12$$

Treat y as a function of x . Show product and chain rule work where needed.

4. Find dy/dx .

$$-4 \cdot x^4 + 2 \cdot y^4 - 2 \cdot y^3 - 4 \cdot x^2 = -76$$

Treat y as a function of x . Show product and chain rule work where needed.

Implicit Differentiation

Find dy/dx for each implicit equation. Treat y as a function of x , and keep product and chain rule factors visible.

5. Find dy/dx .

$$-3 \cdot x^4 \cdot y + x \cdot y - 5 \cdot y = 51$$

Treat y as a function of x . Show product and chain rule work where needed.

6. Find dy/dx .

$$-2 \cdot y^4 + x - 1 \cdot (-2 \cdot x^2 - 4 \cdot y - 2)^4 = -20769$$

Treat y as a function of x . Show product and chain rule work where needed.

Implicit Differentiation

Find dy/dx for each implicit equation. Treat y as a function of x , and keep product and chain rule factors visible.

7. Find dy/dx .

$$2 \cdot x^2 + 2 \cdot y = 10$$

Treat y as a function of x . Show product and chain rule work where needed.

8. Find dy/dx .

$$-4 \cdot x^4 \cdot y + 2 \cdot x^2 \cdot y^2 + 2 \cdot x \cdot y = -4$$

Treat y as a function of x . Show product and chain rule work where needed.

Implicit Differentiation

Find dy/dx for each implicit equation. Treat y as a function of x , and keep product and chain rule factors visible.

9. Find dy/dx .

$$-1 \cdot x - 3 \cdot (-2 \cdot x + y + 4)^3 = -2998$$

Treat y as a function of x . Show product and chain rule work where needed.

10. Find dy/dx .

$$5 \cdot x^4 - 3 \cdot y^2 = 68$$

Treat y as a function of x . Show product and chain rule work where needed.

Implicit Differentiation

Worked Answer Key

Find dy/dx for each implicit equation. Treat y as a function of x , and keep product and chain rule factors visible.

1. Find dy/dx .

Given: $5 \cdot x - 1 \cdot y = -12$

Differentiate: $5 - 1 \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $-1 \cdot \frac{dy}{dx} = -5$

Answer: $dy/dx = \frac{-5}{-1}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.

2. Find dy/dx .

Given: $4 \cdot x^3 \cdot y - 2 \cdot x^3 = 48$

Differentiate: $12 \cdot x^2 \cdot y - 6 \cdot x^2 + 4 \cdot x^3 \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $4 \cdot x^3 \cdot \frac{dy}{dx} = -1 \cdot (12 \cdot x^2 \cdot y - 6 \cdot x^2)$

Answer: $dy/dx = \frac{-1 \cdot (12 \cdot x^2 \cdot y - 6 \cdot x^2)}{4 \cdot x^3}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.

3. Find dy/dx .

Given: $-1 \cdot y - 3 \cdot (-1 \cdot x \cdot y - 1 \cdot x - 2)^2 = -12$

Differentiate: $-6 \cdot (-1 \cdot x \cdot y - 1 \cdot x - 2) \cdot (-1 \cdot y - 1) + (-1 + 6 \cdot (-1 \cdot x \cdot y - 1 \cdot x - 2) \cdot x) \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $(-1 + 6 \cdot (-1 \cdot x \cdot y - 1 \cdot x - 2) \cdot x) \cdot \frac{dy}{dx} = 6 \cdot (-1 \cdot x \cdot y - 1 \cdot x - 2) \cdot (-1 \cdot y - 1)$

Answer: $dy/dx = \frac{6 \cdot (-1 \cdot x \cdot y - 1 \cdot x - 2) \cdot (-1 \cdot y - 1)}{-1 + 6 \cdot (-1 \cdot x \cdot y - 1 \cdot x - 2) \cdot x}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.

4. Find dy/dx .

Given: $-4 \cdot x^4 + 2 \cdot y^4 - 2 \cdot y^3 - 4 \cdot x^2 = -76$

Differentiate: $-16 \cdot x^3 - 8 \cdot x + (8 \cdot y^3 - 6 \cdot y^2) \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $(8 \cdot y^3 - 6 \cdot y^2) \cdot \frac{dy}{dx} = -1 \cdot (-16 \cdot x^3 - 8 \cdot x)$

Answer: $dy/dx = \frac{-1 \cdot (-16 \cdot x^3 - 8 \cdot x)}{8 \cdot y^3 - 6 \cdot y^2}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.

Implicit Differentiation

Worked Answer Key

Find dy/dx for each implicit equation. Treat y as a function of x , and keep product and chain rule factors visible.

5. Find dy/dx .

Given: $-3 \cdot x^4 \cdot y + x \cdot y - 5 \cdot y = 51$

Differentiate: $-12 \cdot x^3 \cdot y + y + \left(-3 \cdot x^4 + x - 5\right) \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $\left(-3 \cdot x^4 + x - 5\right) \cdot \frac{dy}{dx} = -1 \cdot \left(-12 \cdot x^3 \cdot y + y\right)$

Answer: $dy/dx = \frac{-1 \cdot \left(-12 \cdot x^3 \cdot y + y\right)}{-3 \cdot x^4 + x - 5}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.

6. Find dy/dx .

Given: $-2 \cdot y^4 + x - 1 \cdot \left(-2 \cdot x^2 - 4 \cdot y - 2\right)^4 = -20769$

Differentiate: $1 + 16 \cdot \left(-2 \cdot x^2 - 4 \cdot y - 2\right)^3 \cdot x + \left(-8 \cdot y^3 + 16 \cdot \left(-2 \cdot x^2 - 4 \cdot y - 2\right)^3\right) \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $\left(-8 \cdot y^3 + 16 \cdot \left(-2 \cdot x^2 - 4 \cdot y - 2\right)^3\right) \cdot \frac{dy}{dx} = -1 \cdot \left(1 + 16 \cdot \left(-2 \cdot x^2 - 4 \cdot y - 2\right)^3 \cdot x\right)$

Answer: $dy/dx = \frac{-1 \cdot \left(1 + 16 \cdot \left(-2 \cdot x^2 - 4 \cdot y - 2\right)^3 \cdot x\right)}{-8 \cdot y^3 + 16 \cdot \left(-2 \cdot x^2 - 4 \cdot y - 2\right)^3}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.

7. Find dy/dx .

Given: $2 \cdot x^2 + 2 \cdot y = 10$

Differentiate: $4 \cdot x + 2 \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $2 \cdot \frac{dy}{dx} = -4 \cdot x$

Answer: $dy/dx = \frac{-4 \cdot x}{2}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.

8. Find dy/dx .

Given: $-4 \cdot x^4 \cdot y + 2 \cdot x^2 \cdot y^2 + 2 \cdot x \cdot y = -4$

Differentiate: $-16 \cdot x^3 \cdot y + 4 \cdot x \cdot y^2 + 2 \cdot y + \left(-4 \cdot x^4 + 4 \cdot x^2 \cdot y + 2 \cdot x\right) \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $\left(-4 \cdot x^4 + 4 \cdot x^2 \cdot y + 2 \cdot x\right) \cdot \frac{dy}{dx} = -1 \cdot \left(-16 \cdot x^3 \cdot y + 4 \cdot x \cdot y^2 + 2 \cdot y\right)$

Answer: $dy/dx = \frac{-1 \cdot \left(-16 \cdot x^3 \cdot y + 4 \cdot x \cdot y^2 + 2 \cdot y\right)}{-4 \cdot x^4 + 4 \cdot x^2 \cdot y + 2 \cdot x}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.

Implicit Differentiation

Worked Answer Key

Find dy/dx for each implicit equation. Treat y as a function of x , and keep product and chain rule factors visible.

9. Find dy/dx .

Given: $-1 \cdot x - 3 \cdot (-2 \cdot x + y + 4)^3 = -2998$

Differentiate: $-1 + 18 \cdot (-2 \cdot x + y + 4)^2 + -9 \cdot (-2 \cdot x + y + 4)^2 \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $-9 \cdot (-2 \cdot x + y + 4)^2 \cdot \frac{dy}{dx} = -1 \cdot (-1 + 18 \cdot (-2 \cdot x + y + 4)^2)$

Answer: $dy/dx = \frac{-1 \cdot (-1 + 18 \cdot (-2 \cdot x + y + 4)^2)}{-9 \cdot (-2 \cdot x + y + 4)^2}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.

10. Find dy/dx .

Given: $5 \cdot x^4 - 3 \cdot y^2 = 68$

Differentiate: $20 \cdot x^3 + -6 \cdot y \cdot \frac{dy}{dx} = 0$

Collect dy/dx : $-6 \cdot y \cdot \frac{dy}{dx} = -20 \cdot x^3$

Answer: $dy/dx = \frac{-20 \cdot x^3}{-6 \cdot y}$

The denominator in the dy/dx answer must be nonzero on the original curve. When it is zero, this formula does not determine a finite slope.