Name _____ Score _____ Teacher _____ Date _____

General Differential Equations

Find the general solution on an interval of the original domain. Include one arbitrary constant C.

The arbitrary constant C may differ between connected intervals separated by an excluded point or trigonometric pole.

1.

$$\frac{dy}{dx} = -1$$

General solution: _____

2.

$$\frac{dy}{dx} = \frac{-8}{x}$$

General solution: _____

3.

$$\frac{dy}{dx} = \frac{1}{2} \cdot \cos\left(2 + 2 \cdot x\right)$$

General solution: _____

4.

$$\frac{dy}{dx} = -\left(8 \cdot x^3 + 9 \cdot x^2\right)$$

General solution: _____

5.

$$\frac{dy}{dx} = \frac{-5}{x^5}$$

General solution: _____

6.

$$\frac{dy}{dx} = \frac{1}{2} \cdot \sin\left(1 - 2 \cdot x\right)$$

General solution: _____

7.

$$\frac{dy}{dx} = \frac{\frac{-2}{3}}{-\left(1 \cdot x - 3\right)}$$

General solution: _____

8.

$$\frac{dy}{dx} = -1 \cdot \sec\left(3 \cdot x\right)^2$$

General solution: _____

9.

$$\frac{dy}{dx} = -\left(2 \cdot x^3 + 6 \cdot x^2 + 4\right)$$

General solution: _____

10.

$$\frac{dy}{dx} = -1 \cdot \csc\left(3 + 3 \cdot x\right)^2$$

General solution: _____

Name _____ Score _____ Teacher _____ Date _____

General Differential Equations

Worked Answer Key

Find the general solution on an interval of the original domain. Include one arbitrary constant C.

The arbitrary constant C may differ between connected intervals separated by an excluded point or trigonometric pole.

1. General solution

$$\frac{dy}{dx} = -1$$

Integrate each power term with the power rule. Add 1 to each exponent. Divide each coefficient by its new exponent. Add one arbitrary constant C.

Solution: $y = -1 \cdot x + C$

Domain: all real x.

Check: $d/dx\ (-1 \cdot x) = -1$

Differentiate each primitive term: multiply by its power, then lower that power by 1.

2. General solution

$$\frac{dy}{dx} = \frac{-8}{x}$$

Use the reciprocal rule: the integral of 1/x is ln|x|. Keep the coefficient outside the reciprocal rule. Use an absolute value because x may be positive or negative. Add one arbitrary constant C.

Solution: $y = -8 \cdot \ln\left(|x|\right) + C$

Domain: x is not 0; solve on a connected interval not crossing 0.

Check: $d/dx\ \left(-8 \cdot \ln\left(|x|\right)\right) = \frac{-8}{x}$

Differentiate ln|x|: the chain factor is 1, so the recovered numerator is -8/1.

3. General solution

$$\frac{dy}{dx} = \frac{1}{2} \cdot \cos\left(2 + 2 \cdot x\right)$$

Use the matching trigonometric derivative pattern and divide by the inner slope. Match the cosine pattern. Apply the exact sign and inner-slope adjustment. Add one arbitrary constant C.

Solution: $y = \frac{1}{4} \cdot \sin\left(2 + 2 \cdot x\right) + C$

Domain: all real x.

Check: $d/dx\ \left(\frac{1}{4} \cdot \sin\left(2 + 2 \cdot x\right)\right) = \frac{1}{2} \cdot \cos\left(2 + 2 \cdot x\right)$

Multiply the primitive adjustment by the certified derivative factor 2/1; the recovered coefficient is 1/2.

4. General solution

$$\frac{dy}{dx} = -8 \cdot x^3 + 9 \cdot x^2$$

Integrate each power term with the power rule. Add 1 to each exponent. Divide each coefficient by its new exponent. Add one arbitrary constant C.

Solution: $y = -2 \cdot x^4 + 3 \cdot x^3 + C$

Domain: all real x.

Check: $d/dx\ \left(-2 \cdot x^4 + 3 \cdot x^3\right) = -8 \cdot x^3 + 9 \cdot x^2$

Differentiate each primitive term: multiply by its power, then lower that power by 1.

Name _____ Score _____ Teacher _____ Date _____

General Differential Equations

Worked Answer Key

Find the general solution on an interval of the original domain. Include one arbitrary constant C.

The arbitrary constant C may differ between connected intervals separated by an excluded point or trigonometric pole.

5. General solution

$$\frac{dy}{dx} = \frac{-5}{x^5}$$

Rewrite the denominator as a negative power and apply the power rule. Write x^(-5). Add 1 to the exponent and divide by it. Add one arbitrary constant C.

Solution: $y = \frac{5}{4} \cdot x^{-4} + C$

Domain: x is not 0; solve on a connected interval not crossing 0.

Check: $d/dx\ (\frac{5}{4} \cdot x^{-4}) = \frac{-5}{x^5}$

Multiply the primitive coefficient by its power and lower the power by 1 to recover x^(-5).

6. General solution

$$\frac{dy}{dx} = \frac{1}{2} \cdot \sin(1 - 2 \cdot x)$$

Use the matching trigonometric derivative pattern and divide by the inner slope. Match the sine pattern. Apply the exact sign and inner-slope adjustment. Add one arbitrary constant C.

Solution: $y = \frac{1}{4} \cdot \cos(1 - 2 \cdot x) + C$

Domain: all real x.

Check: $d/dx\ (\frac{1}{4} \cdot \cos(1 - 2 \cdot x)) = \frac{1}{2} \cdot \sin(1 - 2 \cdot x)$

Multiply the primitive adjustment by the certified derivative factor 2/1; the recovered coefficient is 1/2.

7. General solution

$$\frac{dy}{dx} = \frac{\frac{-2}{3}}{-1 \cdot x - 3}$$

Use the affine reciprocal rule and divide by the inner slope. The inner derivative is -1. Multiply ln|ax+b| by c/a. Add one arbitrary constant C.

Solution: $y = \frac{2}{3} \cdot \ln(|-1 \cdot x - 3|) + C$

Domain: x is not -3/1; solve on one connected side of the pole.

Check: $d/dx\ (\frac{2}{3} \cdot \ln(|-1 \cdot x - 3|)) = \frac{\frac{-2}{3}}{-1 \cdot x - 3}$

Multiply the primitive coefficient by the inner slope -1; this recovers -2/3 over the affine denominator.

8. General solution

$$\frac{dy}{dx} = -1 \cdot \sec(3 \cdot x)^2$$

Use the matching trigonometric derivative pattern and divide by the inner slope. Match the secant-squared pattern. Apply the exact sign and inner-slope adjustment. Add one arbitrary constant C.

Solution: $y = -\frac{1}{3} \cdot \tan(3 \cdot x) + C$

Domain: cos(3x+0) is not 0; use one connected interval between poles.

Check: $d/dx\ (\frac{-1}{3} \cdot \tan(3 \cdot x)) = -1 \cdot \sec(3 \cdot x)^2$

Multiply the primitive adjustment by the certified derivative factor 3/1; the recovered coefficient is -1/1.

Name _____ Score _____ Teacher _____ Date _____

General Differential Equations

Worked Answer Key

Find the general solution on an interval of the original domain. Include one arbitrary constant C.

The arbitrary constant C may differ between connected intervals separated by an excluded point or trigonometric pole.

9. General solution

$$\frac{dy}{dx} = -\ 2\cdot x^3 + 6\cdot x^2 + 4$$

Integrate each power term with the power rule. Add 1 to each exponent. Divide each coefficient by its new exponent. Add one arbitrary constant C.

Solution: $y = -\ \frac{1}{2}\cdot x^4 + 2\cdot x^3 + 4\cdot x + C$

Domain: all real x.

Check: $d/dx\ (-\ \frac{1}{2}\cdot x^4 + 2\cdot x^3 + 4\cdot x) = -\ 2\cdot x^3 + 6\cdot x^2 + 4$

Differentiate each primitive term: multiply by its power, then lower that power by 1.

10. General solution

$$\frac{dy}{dx} = -1\ \cdot\csc\left(3 + 3\cdot x\right)^2$$

Use the matching trigonometric derivative pattern and divide by the inner slope. Match the cosecant-squared pattern. Apply the exact sign and inner-slope adjustment. Add one arbitrary constant C.

Solution: $y = \frac{1}{3}\cdot\cot\left(3 + 3\cdot x\right) + C$

Domain: sin(3x+3) is not 0; use one connected interval between poles.

Check: $d/dx\ (\frac{1}{3}\cdot\cot\left(3 + 3\cdot x\right)) = -1\ \cdot\csc\left(3 + 3\cdot x\right)^2$

Multiply the primitive adjustment by the certified derivative factor -3/1; the recovered coefficient is -1/1.