MATH240: First Order Separable

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Name: _____ Date: _____ Score: / 30

Learning Objectives

- Calculate the mean, median, mode, and range of a data set
- Compute sample variance and standard deviation
- Construct quartiles, the IQR, and identify outliers
- Describe the shape, center, and spread of a distribution

Simplify each expression completely. Show all steps and circle your final answer.

Separable ODEs

1. Solve the separable ODE: dy/dx = 6x^1. Find the general solution y(x).

$$\int 6x^{1}\,dx$$

Answer: _____

2. A particle's velocity satisfies dv/dt = 1t^2. Find the position function (antiderivative).

$$\int 1x^{2}\,dx$$

Answer: _____

3. Solve: dy/dx = 5x^3. Then find the particular solution satisfying y(0) = 0.

$$\int 5x^{3}\,dx$$

Answer: _____

4. Solve: dy/dx = 5x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 5x^{3}\,dx$$

Answer: _____

5. Solve the separable ODE: dy/dx = 1x^4. Find the general solution y(x).

$$\int 1x^{4}\,dx$$

Answer: _____

6. A particle's velocity satisfies dv/dt = 3t^1. Find the position function (antiderivative).

$$\int 3x^1\,dx$$

Answer: _____

7. Solve: dy/dx = 6x^2. Then find the particular solution satisfying y(0) = 0.

$$\int 6x^2\,dx$$

Answer: _____

8. Solve: dy/dx = 2x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 2x^3\,dx$$

Answer: _____

9. Solve the separable ODE: dy/dx = 4x^3. Find the general solution y(x).

$$\int 4x^3\,dx$$

Answer: _____

10. A particle's velocity satisfies dv/dt = 2t^3. Find the position function (antiderivative).

$$\int 2x^3\,dx$$

Answer: _____

11. Solve: dy/dx = 4x^1. Then find the particular solution satisfying y(0) = 0.

$$\int 4x^1\,dx$$

Answer: _____

12. Solve: dy/dx = 4x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 4x^3\,dx$$

Answer: _____

13. Solve the separable ODE: dy/dx = 2x^4. Find the general solution y(x).

$$\int 2x^4\,dx$$

Answer: _____

14. A particle's velocity satisfies dv/dt = 1t^1. Find the position function (antiderivative).

$$\int 1x^{1}\,dx$$

Answer: _____

15. Solve: dy/dx = 8x^3. Then find the particular solution satisfying y(0) = 0.

$$\int 8x^{3}\,dx$$

Answer: _____

16. Solve: dy/dx = 1x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 1x^{3}\,dx$$

Answer: _____

17. Solve the separable ODE: dy/dx = 5x^2. Find the general solution y(x).

$$\int 5x^{2}\,dx$$

Answer: _____

18. A particle's velocity satisfies dv/dt = 2t^1. Find the position function (antiderivative).

$$\int 2x^{1}\,dx$$

Answer: _____

19. Solve: dy/dx = 4x^2. Then find the particular solution satisfying y(0) = 0.

$$\int 4x^{2}\,dx$$

Answer: _____

20. Solve: dy/dx = 8x^2. Find the coefficient of the x^3 term in the general solution.

$$\int 8x^{2}\,dx$$

Answer: _____

21. Solve the separable ODE: dy/dx = 5x^2. Find the general solution y(x).

$$\int 5x^{2}\,dx$$

Answer: _____

22. A particle's velocity satisfies dv/dt = 4t^2. Find the position function (antiderivative).

$$\int 4x^2\,dx$$

Answer: _____

23. Solve: dy/dx = 5x^1. Then find the particular solution satisfying y(0) = 0.

$$\int 5x^1\,dx$$

Answer: _____

24. Solve: dy/dx = 7x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 7x^3\,dx$$

Answer: _____

25. Solve the separable ODE: dy/dx = 1x^3. Find the general solution y(x).

$$\int 1x^3\,dx$$

Answer: _____

26. A particle's velocity satisfies dv/dt = 1t^1. Find the position function (antiderivative).

$$\int 1x^1\,dx$$

Answer: _____

27. Solve: dy/dx = 7x^2. Then find the particular solution satisfying y(0) = 0.

$$\int 7x^2\,dx$$

Answer: _____

28. Solve: dy/dx = 1x^2. Find the coefficient of the x^3 term in the general solution.

$$\int 1x^2\,dx$$

Answer: _____

29. Solve the separable ODE: dy/dx = 1x^3. Find the general solution y(x).

$$\int 1x^3\,dx$$

Answer: _____

30. A particle's velocity satisfies dv/dt = 3t^3. Find the position function (antiderivative).

$$\int 3x^3\,dx$$

Answer: _____

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ANSWER KEY & SOLUTIONS

Topics: Separable ODEs. All answers verified by independent computation.

Solutions

Separable ODEs

1. Solve the separable ODE: dy/dx = 6x^1. Find the general solution y(x).

$$\int 6x^{1}\,dx$$

→ *Separate variables: dy = 6x^1 dx.*
→ *Integrate both sides: y = integral of 6x^1 dx = 3x^2 + C.*

Answer: $\frac{6}{2}x^{2} + C \;\Rightarrow\; \text{coeff} = 3$

2. A particle's velocity satisfies dv/dt = 1t^2. Find the position function (antiderivative).

$$\int 1x^{2}\,dx$$

→ *Integrate: v(t) = integral of 1t^2 dt = 1/3t^3 + C.*

Answer: $\frac{1}{3}x^{3} + C \;\Rightarrow\; \text{coeff} = 1/3$

3. Solve: dy/dx = 5x^3. Then find the particular solution satisfying y(0) = 0.

$$\int 5x^{3}\,dx$$

→ *Integrate: y = 5/4x^4 + C.*
→ *Apply y(0)=0: 0 = 0 + C, so C = 0.*
→ *Particular solution: y = 5/4x^4.*

Answer: $\frac{5}{4}x^{4} + C \;\Rightarrow\; \text{coeff} = 5/4$

4. Solve: dy/dx = 5x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 5x^{3}\,dx$$

→ *Separate and integrate: y = 5/4x^4 + C.*
→ *The coefficient of x^4 is 5/4.*

Answer: $\frac{5}{4}x^{4} + C \;\Rightarrow\; \text{coeff} = 5/4$

5. Solve the separable ODE: dy/dx = 1x^4. Find the general solution y(x).

$$\int 1x^{4}\,dx$$

→ *Separate variables: dy = 1x^4 dx.*
→ *Integrate both sides: y = integral of 1x^4 dx = 1/5x^5 + C.*

Answer: $\frac{1}{5}x^{5} + C \;\Rightarrow\; \text{coeff} = 1/5$

6. A particle's velocity satisfies dv/dt = 3t^1. Find the position function (antiderivative).

$$\int 3x^{1}\,dx$$

→ *Integrate: v(t) = integral of 3t^1 dt = 3/2t^2 + C.*

Answer: $\frac{3}{2}x^{2} + C \;\Rightarrow\; \text{coeff} = 3/2$

7. Solve: dy/dx = 6x^2. Then find the particular solution satisfying y(0) = 0.

$$\int 6x^2\,dx$$

→ *Integrate: y = 2x^3 + C.*
→ *Apply y(0)=0: 0 = 0 + C, so C = 0.*
→ *Particular solution: y = 2x^3.*

Answer: $\frac{6}{3}x^3 + C \Rightarrow \text{coeff} = 2$

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8. Solve: dy/dx = 2x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 2x^3\,dx$$

→ *Separate and integrate: y = 1/2x^4 + C.*
→ *The coefficient of x^4 is 1/2.*

Answer: $\frac{2}{4}x^4 + C \Rightarrow \text{coeff} = 1/2$

---

9. Solve the separable ODE: dy/dx = 4x^3. Find the general solution y(x).

$$\int 4x^3\,dx$$

→ *Separate variables: dy = 4x^3 dx.*
→ *Integrate both sides: y = integral of 4x^3 dx = 1x^4 + C.*

Answer: $\frac{4}{4}x^4 + C \Rightarrow \text{coeff} = 1$

---

10. A particle's velocity satisfies dv/dt = 2t^3. Find the position function (antiderivative).

$$\int 2x^3\,dx$$

→ *Integrate: v(t) = integral of 2t^3 dt = 1/2t^4 + C.*

Answer: $\frac{2}{4}x^4 + C \Rightarrow \text{coeff} = 1/2$

---

11. Solve: dy/dx = 4x^1. Then find the particular solution satisfying y(0) = 0.

$$\int 4x^1\,dx$$

→ *Integrate: y = 2x^2 + C.*
→ *Apply y(0)=0: 0 = 0 + C, so C = 0.*
→ *Particular solution: y = 2x^2.*

Answer: $\frac{4}{2}x^2 + C \Rightarrow \text{coeff} = 2$

---

12. Solve: dy/dx = 4x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 4x^3\,dx$$

→ *Separate and integrate: y = 1x^4 + C.*
→ *The coefficient of x^4 is 1.*

Answer: $\frac{4}{4}x^4 + C \Rightarrow \text{coeff} = 1$

---

13. Solve the separable ODE: dy/dx = 2x^4. Find the general solution y(x).

$$\int 2x^4\,dx$$

→ *Separate variables: dy = 2x^4 dx.*
→ *Integrate both sides: y = integral of 2x^4 dx = 2/5x^5 + C.*

Answer: $\frac{2}{5}x^5 + C \;\Rightarrow\; \text{coeff} = 2/5$

---

14. A particle's velocity satisfies dv/dt = 1t^1. Find the position function (antiderivative).

$$\int 1x^1\,dx$$

→ *Integrate: v(t) = integral of 1t^1 dt = 1/2t^2 + C.*

Answer: $\frac{1}{2}x^2 + C \;\Rightarrow\; \text{coeff} = 1/2$

---

15. Solve: dy/dx = 8x^3. Then find the particular solution satisfying y(0) = 0.

$$\int 8x^3\,dx$$

→ *Integrate: y = 2x^4 + C.*
→ *Apply y(0)=0: 0 = 0 + C, so C = 0.*
→ *Particular solution: y = 2x^4.*

Answer: $\frac{8}{4}x^4 + C \;\Rightarrow\; \text{coeff} = 2$

---

16. Solve: dy/dx = 1x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 1x^3\,dx$$

→ *Separate and integrate: y = 1/4x^4 + C.*
→ *The coefficient of x^4 is 1/4.*

Answer: $\frac{1}{4}x^4 + C \;\Rightarrow\; \text{coeff} = 1/4$

---

17. Solve the separable ODE: dy/dx = 5x^2. Find the general solution y(x).

$$\int 5x^2\,dx$$

→ *Separate variables: dy = 5x^2 dx.*
→ *Integrate both sides: y = integral of 5x^2 dx = 5/3x^3 + C.*

Answer: $\frac{5}{3}x^3 + C \;\Rightarrow\; \text{coeff} = 5/3$

---

18. A particle's velocity satisfies dv/dt = 2t^1. Find the position function (antiderivative).

$$\int 2x^1\,dx$$

→ *Integrate: v(t) = integral of 2t^1 dt = 1t^2 + C.*

Answer: $\frac{2}{2}x^2 + C \;\Rightarrow\; \text{coeff} = 1$

---

19. Solve: dy/dx = 4x^2. Then find the particular solution satisfying y(0) = 0.

$$\int 4x^2\,dx$$

→ *Integrate: y = 4/3x^3 + C.*
→ *Apply y(0)=0: 0 = 0 + C, so C = 0.*
→ *Particular solution: y = 4/3x^3.*

Answer: $\frac{4}{3}x^3 + C \Rightarrow \text{coeff} = 4/3$

---

20. Solve: dy/dx = 8x^2. Find the coefficient of the x^3 term in the general solution.

$$\int 8x^2\,dx$$

→ *Separate and integrate: y = 8/3x^3 + C.*
→ *The coefficient of x^3 is 8/3.*

Answer: $\frac{8}{3}x^3 + C \Rightarrow \text{coeff} = 8/3$

---

21. Solve the separable ODE: dy/dx = 5x^2. Find the general solution y(x).

$$\int 5x^2\,dx$$

→ *Separate variables: dy = 5x^2 dx.*
→ *Integrate both sides: y = integral of 5x^2 dx = 5/3x^3 + C.*

Answer: $\frac{5}{3}x^3 + C \Rightarrow \text{coeff} = 5/3$

---

22. A particle's velocity satisfies dv/dt = 4t^2. Find the position function (antiderivative).

$$\int 4x^2\,dx$$

→ *Integrate: v(t) = integral of 4t^2 dt = 4/3t^3 + C.*

Answer: $\frac{4}{3}x^3 + C \Rightarrow \text{coeff} = 4/3$

---

23. Solve: dy/dx = 5x^1. Then find the particular solution satisfying y(0) = 0.

$$\int 5x^1\,dx$$

→ *Integrate: y = 5/2x^2 + C.*
→ *Apply y(0)=0: 0 = 0 + C, so C = 0.*
→ *Particular solution: y = 5/2x^2.*

Answer: $\frac{5}{2}x^2 + C \Rightarrow \text{coeff} = 5/2$

---

24. Solve: dy/dx = 7x^3. Find the coefficient of the x^4 term in the general solution.

$$\int 7x^3\,dx$$

→ *Separate and integrate: y = 7/4x^4 + C.*
→ *The coefficient of x^4 is 7/4.*

Answer: $\frac{7}{4}x^4 + C \Rightarrow \text{coeff} = 7/4$

---

25. Solve the separable ODE: dy/dx = 1x^3. Find the general solution y(x).

$$\int 1x^3\,dx$$

→ *Separate variables: dy = 1x^3 dx.*
→ *Integrate both sides: y = integral of 1x^3 dx = 1/4x^4 + C.*

Answer: $\frac{1}{4}x^4 + C \;\Rightarrow\; \text{coeff} = 1/4$

---

26. A particle's velocity satisfies dv/dt = 1t^1. Find the position function (antiderivative).

$$\int 1x^1\,dx$$

→ *Integrate: v(t) = integral of 1t^1 dt = 1/2t^2 + C.*

Answer: $\frac{1}{2}x^2 + C \;\Rightarrow\; \text{coeff} = 1/2$

---

27. Solve: dy/dx = 7x^2. Then find the particular solution satisfying y(0) = 0.

$$\int 7x^2\,dx$$

→ *Integrate: y = 7/3x^3 + C.*
→ *Apply y(0)=0: 0 = 0 + C, so C = 0.*
→ *Particular solution: y = 7/3x^3.*

Answer: $\frac{7}{3}x^3 + C \;\Rightarrow\; \text{coeff} = 7/3$

---

28. Solve: dy/dx = 1x^2. Find the coefficient of the x^3 term in the general solution.

$$\int 1x^2\,dx$$

→ *Separate and integrate: y = 1/3x^3 + C.*
→ *The coefficient of x^3 is 1/3.*

Answer: $\frac{1}{3}x^3 + C \;\Rightarrow\; \text{coeff} = 1/3$

---

29. Solve the separable ODE: dy/dx = 1x^3. Find the general solution y(x).

$$\int 1x^3\,dx$$

→ *Separate variables: dy = 1x^3 dx.*
→ *Integrate both sides: y = integral of 1x^3 dx = 1/4x^4 + C.*

Answer: $\frac{1}{4}x^4 + C \;\Rightarrow\; \text{coeff} = 1/4$

---

30. A particle's velocity satisfies dv/dt = 3t^3. Find the position function (antiderivative).

$$\int 3x^3\,dx$$

→ *Integrate: v(t) = integral of 3t^3 dt = 3/4t^4 + C.*

Answer: $\frac{3}{4}x^4 + C \;\Rightarrow\; \text{coeff} = 3/4$
