



MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

DIFFERENTIAL EQUATIONS AND THEIR FORMATION

Solved Examples

1. Write the order and the degree of the differential equation $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 3y = 0.$

Watch Video Solution

2. Write the order and the degree of the diffential equation

$$x igg(rac{d^3y}{dx^3} igg)^2 + igg(rac{dy}{dx} igg)^4 + y^2 = 0.$$

3. Write the order and degree of the differential equation

$$y=xrac{dy}{dx}+\sqrt{1+\left(rac{dy}{dx}
ight)^2}.$$

Watch Video Solution

4. Write the order and degree of the differential equation

$$igg\{1+\left(rac{dy}{dx}
ight)^2igg\}^{3/2}=kigg(rac{d^2y}{dx^2}igg).$$

A. order = 2 and degree =2

B. order = 3 and degree =2

C. order = 1 and degree =2

D. order = 2 and degree not exist

Answer: A

5. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear: $y = px + \sqrt{a^2p^2 + b^2}$, where $p = \frac{dy}{dx}$

Watch Video Solution

6. Find the order and degree (if any) of each of the differential equations

$$(i)\frac{dy}{dx} - \tan x = 0 \qquad (ii)\left(\frac{dy}{dx}\right)^2 + y = e^x$$

$$(iii)\frac{d^2y}{dx^2} = \sin 3x + \cos 3x \quad (iv)(y'')^2 + \cos y' = 0$$

$$(v)y + 2y' + \sin y = 0 \qquad (vi)\frac{d^4y}{dx^4} + \sin\left(\frac{d^3y}{dx^3}\right) = 0$$

$$(vii)y'' + y^2 + e^{y'} = 0 \qquad (viii)3\frac{d^2y}{dx^2} + 5\left(\frac{dy}{dx}\right)^2 = \log x$$

Watch Video Solution

7. Verify that $y = A \cos x - B \sin x$ is a solution of the differential

equation
$$rac{d^2y}{dx^2}+y=0$$

8. Show that $y = ae^{2x} + be^{-x}$ is a solution of the differential equation $rac{d^2y}{dx^2} - 2y = 0.$

Watch Video Solution

9. Show that $y = Ax + \frac{B}{x}, x \neq 0$ is a solution of the differential equation $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = 0$

Watch Video Solution

10. Prove that the differential equation for $a\cos(\log x) + b\sin(\log x)$ is

$$x^2rac{d^2y}{dx^2}+xrac{dy}{dx}+y=0$$

11. Verify that $y = e^{m \sin^{-1} x}$ is a solution of the differential equation

$$ig(1-x^2)rac{d^2y}{dx^2}-xrac{dy}{dx}-m^2y=0.$$

12. Show that, $v = \frac{A}{r} + B$ satisfies the differential equation $\frac{d^2v}{dr^2} + \frac{2}{r} \cdot \frac{dv}{dr} = 0$

Watch Video Solution

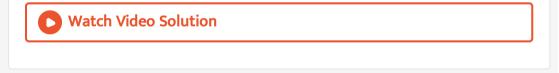
13. Prove that $x^2-y^2=cig(x^2+y^2ig)^2$ is the general solution of differential equation $ig(x^3-2xy^2ig)dx=ig(y^3-3x^2yig)dy$, where c is a parameter.

Watch Video Solution

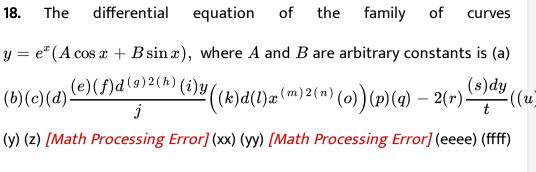
14. Prove that $xy = ae^x + be^{-x} + x^2$ is the general solution of the differential equation $xrac{d^2y}{dx^2} + 2rac{dy}{dx} - xy + x^2 - 2 = 0.$

15. Verify that the function $y = c_1 eax \cos bx + c_2 eax \sin bx$, where c_1, c_2 are arbitrary constants is a solution of the differential equation. $\frac{d^2y}{dx^2} - 2a\frac{dy}{dx} + (a^2 + b^2)y = 0$ Watch Video Solution

16. Write the differential equation representing the family of curves y = mx, where m is an arbitrary constant.



17. Find the differential equartion of the family of curves $y = Ae^x + Be^{-x}$, where A and B are arbitrary constants.



[Math Processing Error] (ddddd)

Watch Video Solution

19. Find the differential equation of the family of all straight lines.

Watch Video Solution

20. Obtain the differential equation of all circles of radius r_{\cdot}

21. From the differential equation of the family of all circles in first quadrant and touching the coordinate axes.

O Watch Video Solution

22. Form the differential equation of the family of circles touching the x-axis at origin.

Watch Video Solution

23. From the differential equation of the family of all parabolas having vertex at the origin and axis along the positive direction of the x-axis is given by



24. Form the differential equation representing the family of ellipses having foci on x-axis and centre at the origin.



25. From the differential equation for the family of the curves $(y-b)^2 = 4(x-a)$, where a and b are parameters.

Watch Video Solution

26. From the differential equation for the family of the curves $ay^2 = (x-c)^3$, where c is a parameter.

Watch Video Solution

27. From the differential equation for the family of the curves $y^2=aig(b^2-x^2ig),$ where a and b are arbitrary constants.





Exercise 18 A

1. Write order and degree (if defined) of each of the following differential

equations.

$$\left(rac{dy}{dx}
ight)^4 + 3y igg(rac{d^2y}{dx^2}igg) = 0$$

Watch Video Solution

2. Write order and degree (if defined) of each of the following differential

equations.

$$x^3 igg(rac{d^2 y}{dx^2} igg)^2 + x igg(rac{dy}{dx} igg)^4 = 0$$

equations.

$$\left(rac{d^2y}{dt^2}
ight)^2+x{\left(rac{ds}{dt}
ight)}^3+4=0$$

Watch Video Solution

4. Write order and degree (if defined) of each of the following differential

equations.

$$\left(rac{d^3y}{dx^3}
ight)+\left(rac{d^2y}{dx^2}
ight)^3+\left(rac{dy}{dx}
ight)^4+y^5=0$$

Watch Video Solution

5. Write order and degree (if defined) of each of the following differential

equations.

$$rac{d^2y}{dx^2} + \left(rac{dy}{dx}
ight)^2 + 2y = 0$$

equations.

$$rac{dy}{dx}+y=e^x$$

Watch Video Solution

7. Write order and degree (if defined) of each of the following differential

equations.

$$rac{d^2 y}{dx^2} + y^2 + e^{(\,dy\,/\,dx\,)} \, = 0$$

Watch Video Solution

8. Write order and degree (if defined) of each of the following differential

equations.

$$rac{dy}{dx}+\sin\!\left(rac{dy}{dx}
ight)=0$$

equations.

$$rac{d^4y}{dx^4}-\cosiggl(rac{d^3y}{dx^3}iggr)=0$$

Watch Video Solution

10. Write order and degree (if defined) of each of the following differential equations.

$$rac{d^2y}{dx}+5xiggl(rac{dy}{dx}iggr)^2-6y=\log x$$

Watch Video Solution

11. Write order and degree (if defined) of each of the following differential

equations.

$$\left(rac{dy}{dx}
ight)^3 - 4 \left(rac{dy}{dx}
ight)^2 + 7y = \sin x$$

equations.

$$rac{d^3y}{dx^3}+2rac{d^2y}{dx^2}+rac{dy}{dx}=0$$

Watch Video Solution

13. Write order and degree (if defined) of each of the following differential

equations.

$$xigg(rac{dh}{dx}igg)+rac{2}{igg(rac{dy}{dx}igg)}+9=y^2$$

Watch Video Solution

14. Write order and degree (if defined) of each of the following differential equations.

$$\sqrt{1-\left(rac{dy}{dx}
ight)^2}=\left(arac{d^2y}{dx^2}
ight)^{1/3}$$

equations.

$$\sqrt{1-y^2}dx+\sqrt{1-x^2}dy=0$$

Watch Video Solution

16. Write order and degree (if defined) of each of the following differential

equations.

$$(y')^3 + (y')^2 + \sin y' + 1 = 0$$

Watch Video Solution

17. Write order and degree (if defined) of each of the following differential

equations.

 $(3x+5y)dy-4x^2dx=0$

equations.

$$y=rac{dy}{dx}+rac{5}{\left(rac{dy}{dx}
ight)}$$

Watch Video Solution

Exercise 18 B

1. Verify that $x^2 = 2y^2\log y$ is a solution of the differential equation

$$ig(x^2+y^2ig)rac{dy}{dx}-xy=0.$$

Watch Video Solution

2. Verify tht $y=e^x$ cos bx is a solution of the differential equation $rac{d^2y}{dx^2}-2rac{dy}{dx}+2y=0.$

3. Verify that
$$y = e^{m \cos^{-1} x}$$
 satisfies the differential equation
 $(1 - x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - m^2 y = 0$
Watch Video Solution

4. Verify that $y = (a + bc)e^{2x}$ is the general solution of the differential

equation
$$rac{d^2y}{dx^2} - 4rac{dy}{dx} + 4y = 0.$$

Watch Video Solution

5. Show that $y = e^x (A \cos x + B \sin x)$ is the solution of the differential

equation
$$rac{d^2y}{dx^2} - 2rac{dy}{dx} + 2y = 0.$$

Watch Video Solution

6. Verify that $y=A\cos 2x-B\sin 2x$ is the general solution of the differential equation $rac{d^2y}{dx^2}+4y=0.$



7. Show that $y = ae^{2x} + be^{-x}$ is a solution of the differential equation $rac{d^2y}{dx^2} - 2y = 0.$

Watch Video Solution

8. Show that $y = e^x (A \cos x + B \sin x)$ is the solution of the differential

equation
$$rac{d^2y}{dx^2}-2rac{dy}{dx}+2y=0.$$

Watch Video Solution

9. Verify that $y=ce^{tan-1_x}$ is a solution of differential equation $(1+x^2)rac{d^2y}{dx^2}+xrac{dy}{dx}=0.$

10. Verify that $y=ce^{tan-1_x}$ is a solution of differential equation $(1+x^2)rac{d^2y}{dx^2}+xrac{dy}{dx}=0.$

Watch Video Solution

11. Show that $y = Ae^{Bx}$ is as solution of the differential equation $\frac{d^2y}{dx^2} = \frac{1}{y} \left(\frac{dy}{dx}\right)^2$.

Watch Video Solution

12. Verify that $y = \frac{a}{x} + b$ is a solution of the differential equation $\frac{d^2y}{dx^2} + \frac{2}{x}\left(\frac{dy}{dx}\right) = 0.$

Watch Video Solution

13. Verify the solution problems: Show that $y = e^{-x} + ax + b$ is solution

of the differential equation
$$e^x rac{d^y}{dx^2} = 1$$

14. Show that $Ax^2 + By^2 = 1$ is a solution of the differential equation

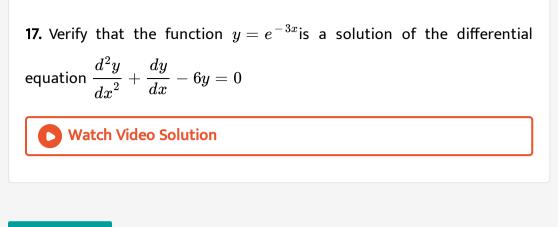
$$x igg\{ y \, rac{d^2 y}{dx^2} + \left(rac{dy}{dx}
ight)^2 igg\} = y rac{dy}{dx} .$$

Watch Video Solution

15. Verify that $y=rac{c-x}{1+cx}$ is a solution of the differential equation $(1+x^2)rac{dy}{dx}+(1+y^2)=0.$

Watch Video Solution

16. Verify that $y = \log \left(x + \sqrt{x^2 + a^2}\right)$ satisfies the differential equation $d^2 rac{y}{dx^2} + x rac{dy}{dx} = 0$



1. Write the differential equation formed from the equation y=mx+c ,

here m and c are arbitrary constants.



Exercise 18 C

2. From the differential equation of the family of concentric circles

 $x^2+y^2=a^2, wherea>0$ and a is a parameter.

3. From the differential equation of the family of curves, $y = a \sin(bx + c)$, where a and c are parameters.



4. Find the differential equation of the family of curves, $x = A \cos nt + B \sin nt$, where A and B are arbitrary constants.

Watch Video Solution

5. Form the differential equation of the family of curves $y=A\;e^{B\,x}$ where

A and B are constants.



6. From the differential equation of the family of curves $y^2 = m ig(a^2 - x^2ig),$ where a and m are parameters.

7. Form the differential equation representing the family of curves given

by $\left(x-a
ight)^2+2y^2=a^2$, where a is an arbitrary constant.

Watch Video Solution

8. From the differential equation of the family of curves given by $x^2 + y^2 - 2ay = a^2$, where a is an arbitrary constant.



9. Form the differential equation of the family of circles touching the y-axis at origin.



10. Form a differential equation of family of all circles having center on

the x - axis and radius 2 units.



11. Form the differential equation of the family of circles in the second quadrant and touching the coordinate axes.

Watch Video Solution

12. From the differential equaiton of the family of circles having coentres

on the x-axis and radius unity.



13. Obtain the differential equation of the family of circles passing through the point (a,0) and (-a,0).



14. Form the differential equation of the family of parabolas having vertex

at origin and axis along positive y-axis.

Watch Video Solution

15. Form the differential equation of the family of ellipses having foci on

y-axis and centre at origin.

Watch Video Solution

16. Form the differential equation of the family of hyperbola having foci

on x-axis and center at the origin.