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MATH 237-S4
HW#1

NB1) $$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} + w\frac{\partial u}{\partial z} = \nu\left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right] - \frac{1}{\rho}\frac{\partial p}{\partial x}$$

Classification: I: indep var: t, x, y, z
II: dep var: u, p
III: order: 2nd order
IV: Partial Diff Eqn
V: nonlinear

Section 1.1

1) $$5\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 9x = 2\cos(3t)$$

Classification: I: indep. var: t
II: dep. var: x
III: order: 2nd order
IV: Ordinary Diff. Eqn
V: linear
VI: Constant coefficient
VII: Non-homogenous

4) $$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$

Classification: I: indep. var: x, y
II: dep. var: u
III: order: 2nd order
IV: Partial Diff. Eqn
V: linear
VI: Constant coefficient
VII: homogenous

6) $$\frac{dx}{dt} = k(4-x)(1-x)$$

Classification: I: indep. var: t
II: dep. var: x
III: order: 1st order
IV: Ordinary Diff. Eqn
V: nonlinear

10) $y\dfrac{d^4y}{dx^4} = x(1-x)$

Classification: I: indep var: x
II dep var: y
III order: 4th order
IV Ordinary Diff. Eqn
V: linear
VI: Variable coefficient
VII: Non-homogeneous

11) $\dfrac{\partial N}{\partial t} = \dfrac{\partial^2 N}{\partial r^2} + \dfrac{1}{r}\dfrac{\partial N}{\partial r} + kN$ (k is a constant)

Classification: I: indep var: t, r
II: dep var: N
III: order: 2nd order
IV: Partial Diff. Eqn
V: linear
VI: variable coefficient
VII: homogeneous

NB2) $y' + y = 0$, $y = Ce^{-x}$, $y(0) = 2$

$y' = -Ce^{-x}$

$(-Ce^{-x}) + (Ce^{-x}) = 0$

$= C(-e^{-x} + e^{-x}) = 0$

$C \cdot 0 = 0$ ✓

$2 = Ce^{-(0)}$

$2 = C \cdot 1$

$2 = C$

NB3) $y' + y\tan(x) = \cos(x)$, $y = (x+C)\cos(x)$, $y(\pi) = 0$

$y' = \cos(x) - (x+C)\sin(x)$

$\cos(x) - \boxed{(x+C)\sin(x)} + \boxed{(x+C)\cos(x)\tan x} = \cos(x)$

$\cos(x) - \boxed{(x+C)\sin(x)} + \boxed{(x+C)\cancel{\cos(x)} \cdot \frac{\sin(x)}{\cancel{\cos(x)}}} = \cos(x)$

$\cos(x) - \cancel{\boxed{(x+C)\sin(x)}} + \cancel{\boxed{(x+C)\sin(x)}} = \cos(x)$

$\cos(x) = \cos(x)$ ✓

$0 = (\pi + C)\cos(\pi)$

$0 = -1(\pi + C)$

$0 = -\pi - C \rightarrow C = -\pi$

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MATH 237-54
HW #1

8) $y = 3\sin(2x) + e^{-x}$ $\qquad$ $y'' + 4y = 5e^{-x}$
$y' = 6\cos(2x) - e^{-x}$
$y'' = -12\sin(2x) + e^{-x}$

$y'' + 4y = 5e^{-x}$
$(-12\sin(2x) + e^{-x}) + 4(3\sin(2x) + e^{-x}) = 5e^{-x}$
$(-12\sin(2x) + e^{-x}) + (12\sin(2x) + 4e^{-x}) = 5e^{-x}$
$e^{-x} + 4e^{-x} = 5e^{-x}$
$5e^{-x} = 5e^{-x}$

Direction field questions

16) $y' = 1$: C because each line has a slope of 1

17) $y' = y$: D because as the slope lines get further from the x-axis, the more vertical they get.

18) $y' = y/t$: F because all direction fields on y/t have a slope of 1.

19) $y' = t^2$: B because the direction fields become closer to 0 as they approach the y axis.

20) $y' = t^2 + y^2$: E because is strictly resembles ($y' = t^2$), except it has a tighter spread.

21) $y' = 1/t$: A because the function begins to cusp towards the y-axis