Answers:

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E 1. (E) Second order nonlinear

D 2. the value of r for which $y=e^{mx}$ is a solution of $y''-5y'+6y=0$

$y=e^{mx}$, $y'=me^{mx}$, $y''=m^2e^{mx}$

$y''-5y'+6y=0$, $m^2e^{mx}-5(me^{mx})+6(e^{mx})\stackrel{?}{=}0$

$0=(m^2-5m+6)e^{mx}$, $(m-3)(m-2)e^{mx}=y$

$m=2,3$

A 3. Values of m for which $y=x^m$ is a solution of $x^2y''-5xy'+8y=0$

$y=x^n$, $y'=mx^{m-1}$, $y''=(m-1)m\cdot x^{m-2}=(m^2-m)x^{m-2}$

$x^2y''-5xy'+8y=0$

$x^2((m^2-m)x^{m-2})-5x(mx^{m-1})+8(x^m)=0$

$(m^2-6m+8)x^m=0$, $(m-4)(m-2)x^m=0$

$m=2,4$ if $x\neq0$

C 4. The values of C for which $y=C$ is a constant solution of

$y'=y^2+3y-4$

$y'=C^2+3C-4$, $(C-1)(C+4)=0$

$C=1,-4$

E 5. The values of m for which $y=e^{mx}$ is a solution of $y''-4y'-5y=0$

$y=e^{mx}$, $y'=me^{mx}$, $y''=m^2e^{mx}$

$m^2e^{mx}-4me^{mx}-5e^{mx}=0$, $(m^2-4m-5)e^{mx}=0$

$(m-5)(m+1)e^{mx}=0$, $m=5,-1$

A 6. $\frac{dP}{dt}=kP$, $P(0)=1000$

A 7. $y=Ce^{3x}$ is solution to IVP $y'=3y$, $y(0)=2$ where $C=?$

$y'=3Ce^{3x}=3y$, $C(3e^0)=6$, $3C=6$, $C=2$

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B 8. $y' = 2y + x$, $x(1) = \frac{1}{4}$, Solution: $y = -\frac{x}{2} - \frac{1}{4} + Ce^{2x}$ where $C = ?$

$y' = 2Ce^{2x} - \frac{1}{2}$, $2Ce^{2x} - \frac{1}{2} = 2y + x$, $C(2e^2) - \frac{1}{2} = \frac{1}{2} + 1$

$C \cdot 2e^2 = 2$, $C \cdot e^2 = 1$, $C = 1/e^2$

C 9. $\frac{dT}{dt} = k(T - 70)$

B 10. $\frac{dA}{dt} = 8 - \frac{1}{100}A$, $R_{in} = 2 \cdot 4 = 8$, $R_{out} = \frac{A(t)}{100} \cdot 4$