Special Problem B-1

For each of the following differential equations, answer the following about the ODE:

(i) What is the order?

(ii) Is it linear?

(iii) If linear, is it homogeneous?

(iv) If linear, are the coefficients constant?

(v) Is it an IVP or a BVP?

Note that most of these are ODEs that we will solve later in the course.

	ODE	ICs/BCs	Notes
(a)	$m\frac{d^2x}{dt^2} + \xi\frac{dx}{dt} + kx = -mg$	$x(0) = L$ $\frac{dx}{dt}(0) = 0$	$x = x(t)$, m, ξ, k, g, L are constants
(b)	$r^4\frac{d^4f}{dr^4} - 4r^2\frac{d^2f}{dr^2} + 8r\frac{df}{dr} - 8f = 0$	$f(R) = 0$ $\frac{df}{dr}(R) = 0$ $f(\infty) \to Ur^2/2$	$f = f(r)$, R, U, are constants
(c)	$\frac{1}{r}\frac{d}{dr}\left(r(1+\epsilon\theta)\frac{d\theta}{dr}\right) = 1 + \epsilon\theta$	$\theta(1) = 0$ $\frac{d\theta}{dr}(0) = 0$	$\theta = \theta(r)$, ϵ is a constant
(d)	$\frac{d^2C}{dx^2} = kC$	$C(0) = 0$ $C(L) = 0$	$C = T(x)$, k and L are constants
(e)	$\frac{d\psi}{d\eta} + \frac{a\eta}{2}\psi = 0$	$\psi(0) = -\sqrt{a/\pi}$	$\psi = \psi(\eta)$, a is a constant
(f)	$\frac{d}{dr}\left(\frac{1}{r}\frac{d}{dr}(rv)\right) = 0$	$v(\kappa R) = 0$ $v(R) = \Omega$	$v = v(r)$, κ, R, Ω are constants