(3)

Also, as x becomes larger the highest power of x becomes dominant, so for large x, $v(x) \simeq x^3$, $\frac{dv}{dx} \simeq 3x^2$

so for a phase point initially at $x=2$, x increases without bound.

It would have been sufficient to evaluate the approximate relation $\dot{x} = v(x) \sim x^3$ to show that motion terminates ~~later~~ or quote some results.

Actually no analysis was required for full marks.

$$\frac{dx}{dt} = v(x) = (x-1)^2(x+3)$$

$$\therefore \int_0^t dt = \int_2^x \frac{dx}{(x-1)^2(x+3)}$$

$$\frac{1}{(x-1)^2(x+3)} = \frac{A}{(x-1)} + \frac{B}{(x-1)^2} + \frac{C}{(x+3)}$$

$$\therefore 1 = A(x-1)(x+3) + B(x+3) + C(x-1)^2$$

$x=1$

$$1 = A(1-1)(1+3) + B(1+3) + C(1-1)^2$$

$$1 = 4B \Rightarrow B = 1/4$$

$x=-3$

$$1 = A(-3-1)(-3+3) + 1/4(-3+3) + C(-3-1)^2$$

$$1 = 16C \Rightarrow C = 1/16$$

$x=0$

$$1 = A(0-1)(0+3) + 1/4(0+3) + 1/16(0-1)^2$$

$$= -3A + 3/4 + 1/16$$

$$-3A = 1 - 3/4 - 1/16 = (16-12-1)/16$$

$$-3A = 3/16 \Rightarrow A = -1/16$$

$$\therefore \frac{1}{(x-1)^2(x+3)} = \frac{-1/16}{(x-1)} + \frac{1/4}{(x-1)^2} + \frac{1/16}{(x+3)}$$

$\frac{4}{4}$

Check:

$$\frac{1}{(x-1)^2(x+3)} = \frac{-1/16}{(x-1)} + \frac{1/4}{(x-1)^2} + \frac{1/16}{(x+3)}$$

$$= \frac{-1/16(x-1)(x+3) + 1/4(x+3) + 1/16(x-1)^2}{(x-1)^2(x+3)}$$