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Normal to Parametric Curve | Past Paper Question | C4 Edexcel January 2013 Q5(c)

The figure shows a sketch of part of the curve C with parametric equations $x = 1 - \frac{1}{2}t$, $y = 2^t - 1$

The curve crosses the y -axis at the point A and crosses the x -axis at the point B .

Find an equation of the normal to C at the point A .

$\frac{d}{dx}(a^x) = a^x \ln a$

At $A: x=0 \Rightarrow 0 = 1 - \frac{1}{2}t \Rightarrow t=2, y=3$

$\frac{dy}{dt} = 2^t \ln 2$
 $\frac{dx}{dt} = -\frac{1}{2}$
 $\therefore \frac{dt}{dx} = -2$

$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$
 $= (2^t \ln 2)(-2)$
 $= -2^{t+1} \ln 2$

\therefore when $t=2, \frac{dy}{dx} = -8 \ln 2$
 \therefore grad of normal $= \frac{1}{8 \ln 2}$
 \therefore Equation of normal at A is:
 $y - 3 = \frac{1}{8 \ln 2} x$

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