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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  $A$ .

$\frac{d}{dx}(a^{2x}) = a^{2x} \ln a$

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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