1) Find the equations of the tangents to the curve that pass through the point $(17, 22)$.

$x = 4t^2 + 1$
$y = 3t^3 - 2$

Note: This problem is similar to the challenge problem number 4 from section 3.2.

Let t=A be the value of t that points to the point on the curve whose tangent line will go through the point (17, 22).

The general form of the tangent line is

$y - y(A) = m_{tan} (x - x(A))$

$$m_{tan} = \left.\frac{dy}{dx}\right|_{t=a}$$

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{9t^2}{8t} = \frac{9t}{8} \qquad \left.\frac{dy}{dx}\right|_{t=A} = \frac{9A}{8}$$

Thus the equation of the tangent line is:

$$y - (3A^3 - 2) = \frac{9A}{8}\left(x - (4A^2 + 1)\right)$$

This line goes through the point x=17 and y=22.

$$22 - 3A^3 + 2 = \frac{9A}{8}(17 - 4A^2 - 1)$$

$$8(24 - 3A^3) = 9A(16 - 4A^2)$$

$$192 - 24A^3 = 144A - 36A^3$$

$$12A^3 - 144A + 192 = 0$$

$$12(A^3 - 12A + 16) = 0$$

Now factor the cubic polynomial. This factoring can be a bit challenging.

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$$12(A^3 - 12A + 16) = 0$$

If you examine the equation you can notice that A=2 is a solution. This takes a bit of plugging in numbers and trying for a solution.

Since A=2 is a solution, this means that (A-2) is a factor of the above equation. Usin this fact and long division we can finnish factoring.

$$\begin{array}{r|l}
 & A^2 + 2A - 8 \\
\hline
A-2 & A^3 + 0A^2 - 12A + 16 \\
 & -(A^3 - 2A^2) \\
\hline
 & \quad 2A^2 - 12A \\
 & \quad -(2A^2 - 4A) \\
\hline
 & \qquad -8A + 16 \\
 & \qquad -(-8A + 16) \\
\hline
 & \qquad\qquad 0
\end{array}$$

Thus we get the following. Now factor the quadratic.

$$12(A-2)(A^2 + 2A - 8) = 0$$

$$12(A-2)(A-2)(A+4) = 0$$

Thus $A = 2$ or $A = -4$

general formula of the tangent line. created earlier in the problem.

$$y-(3A^3-2)=\frac{9A}{8}\left(x-(4A^2+1)\right)$$

$A=2$

$$y-(3(2)^3-2)=\frac{9(2)}{8}\left(x-(4(2)^2+1)\right)$$

$$\boxed{y-22=\frac{9}{4}(x-17)}$$

$A=-4$

$$\boxed{y+194=\frac{-9}{2}(x-65)}$$