Pencil and Paper homework Number 5

This homework is concerned with finding tangent lines to curves. I will give an example and then you will do the problems.

I wish to find the tangent line to the function $f(x) = 3x^2 - 3x - 1$ at the point where $x = 2$. First I find the point $(x, f(x))$. Since x-vlaue of the point is 2, we get the y-coordinate by $y = f(2) = 3 * 2^2 - 3 * 2 - 1 = 5$ so the point on the curve is $(2, 5)$. Next we find the derivative $f'(x) = 6x - 3$. You can now do this the *easy way*. Next, to find the slope m of the tangent line we insert the x value 2 into the derivative to get $m = f'(2) = 6 * 2 - 3 = 9$. Now to get the tangent line we use the point slope formula

$$y - y_0 = m(x - x_0)$$

In our case $(x_0, y_0) = (2, 5)$ and $m = 9$. Thus

$$\begin{aligned} y - y_0 &= m(x - x_0) \\ y - 5 &= 9(x - 2) \\ y - 5 &= 9x - 18 \\ y &= 9x - 18 + 5 \\ y &= 9x - 13 \end{aligned}$$

That's it. Notice that a tangent line always has the form $y = mx + b$. If it doesn't look like that you screwed up.

In each problem do as I did above and also (use calculator) sketch a graph of both *function* and *tangent line*. The picture will tell you if you did it right.

1) Find the tangent line to $y = x^2$ when $x = 1$
2) Find the tangent line to $y = x^2 - 1$ when $x = 2$
3) Find the tangent line to $y = x^2 - x - 4$ when $x = 2$
4) Find the tangent line to $y = x^3 - 4x$ when $x = 2$
5) Find the tangent line to $y = \sqrt{x}$ when $x = 2$
6) Find the tangent line to $y = \sin(x)$ when $x = \pi/3$
7) Find the tangent line to $y = e^x$ when $x = 0$
8) Find the tangent line to $y = e^x$ when $x = 1$
9) Find the tangent line to $y = \ln(x)$ when $x = 1$