Linear Approximations

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Sometimes, we might not be able to calculate the equation of a tangent line at a specific point, but we can find the equation of the tangent line at a nearby point. If this is the case, we can use a *linear approximation* to get a value that's really close to the actual answer that we are not able to find.

To do this:
1. Find the equation of the tangent line at a relatively close point.
2. Substitute in the nearby x-value to find the approximation for y.
3. If the function is **concave up**, your approximation is an **under-estimate**.
4. If the function is **concave down**, your approximation is an **over-estimate**.

**1. The function f is twice differentiable with $f(2) = 1$, $f'(2) = 4$, and $f''(2) = 3$. What is the value of the approximation of $f(1.9)$ using the line tangent to the graph of f at x = 2?

**2(FR).

x	-1.5	-1	-0.5	0	0.5	1	1.5
$f(x)$	-1	-4	-6	-7	-6	-4	-1
$f'(x)$	-7	-5	-3	0	3	5	7

Let f be a function that is differentiable for all real numbers. The table above gives the values of f and its derivative f' for selected points x in the closed interval [-1.5, 1.5]. The second derivative of f has the property that $f'' > 0$ for [-1.5, 1.5], which means f is concave up on that interval .

Write an equation of the line tangent to the graph of f at the point where $x = 1$. Use this line to approximate the value of $f(1.2)$. Is this approximation greater than or less than the actual value of $f(1.2)$? Give a reason for your answer.