Basic Calculus | 4th Quarter

Mini Task 1: Definition of Derivatives

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1. Find the equation of the tangent line to the graph of the equation $f(x)=2x^2-4x-3$ at [illegible]. Sketch the graph and show the segment of the tangent line at $(3,3)$.

Solutions:

$f(x_1)=2(3)^2-4(3)-3$
$f(x_1)=18-12-3$
$f(x_1)=3$

$f(x_1+h)=2(3+h)^2-4(3+h)-3$
$f(x_1+h)=2(9+6h+h^2)-12-4h-3$
$f(x_1+h)=18+12h+h^2-12-4h-3$
$f(x_1+h)=h^2+8h+3$

$\frac{dy}{dx}=f'(x)=\lim_{h\to 0}\frac{f(x_1+h)-f(x_1)}{h}$
$\lim_{h\to 0}\frac{2h^2+8h-3+3}{h}$
$\lim_{h\to 0}\frac{2h(h+4)}{h}$
$\lim_{h\to 0}2h+8$
$\lim_{h\to 0}2(0)+8$
$\frac{dy}{dx}=f'(x)=\lim_{h\to 0}8$

Equation of Tangent Line:
$y=mx+b$
$3=8(3)+b$
$3-24=b$
$b=-21$

$y=mx+b$
$y=8x-21$

x-intercept of $f(x)$:
$let\ y=0$
$x_1=2.58$
$x_2=-0.58$

y-intercept of $f(x)$:
$let\ x=0$

$y=2(0)^2-4(0)-3$
$y=-3$

vertex (h,k) of $f(x)$:

$h=\frac{-b}{2a}=\frac{-(-4)}{2(2)}=\frac{4}{4}$
$h=1$
$k=\frac{4ac-b^2}{4a}=\frac{4(2)(-3)-(-4)^2}{4(2)}=\frac{-24-16}{8}=\frac{-40}{8}$
$k=-5$

x-intercept of tangent line:

let $y=0$
$0=8x-21$
$21=8x$
$\frac{21}{8}=\frac{8x}{8}$
$x=2.625$

y-intercept of tangent line:

let $x=0$
$y=-21$