Example

Find the equation of the line tangent to $f(x) = x^2 - 3x + 8$ at $x = 3$. $y = 3x - 1$

perpendicular to tangent — normal line

Find the equation of the ~~line tangent~~ to $f(x) = x^2 - 3x + 8$ at $x = 3$. $(3, 8)$

$f'(x) = 2x - 3$

1. slope $f'(3) = 2(3) - 3 = 3$

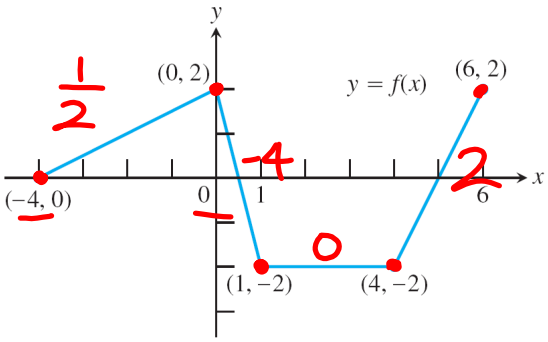
normal line $m = -\frac{1}{3}$

$y - 8 = -\frac{1}{3}(x - 3)$

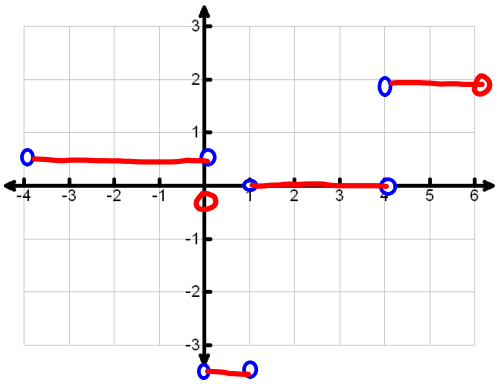
$y = -\frac{1}{3}x + 9$

Example

Sketch a graph of $f'(x)$.



f(x)



f'(x)

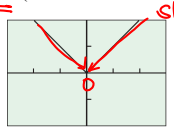
Graphs Differentiablity.tii

When is a function NOT differentiable?

. . . when the limit of the difference quotient does not exist at a value $x = a$.

1. **Corner** (the one-sided limits differ)

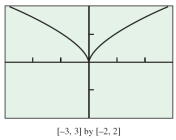
slopes



[−3, 3] by [−2, 2]

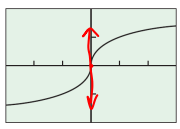
2. **Cusp** (the limit of the difference quotient approaches ∞ from one side and $-\infty$ from the other side)

y =



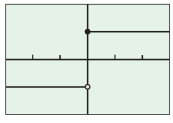
[−3, 3] by [−2, 2]

3. **Vertical Tangent** (the limit of the difference quotient approaches ∞ or $-\infty$ from both sides)



[−3, 3] by [−2, 2]

4. **Discontinuity** (one or both sides of the difference quotient will not exist)



[−3, 3] by [−2, 2]

* Look at a graph to determine differentiablity.

Example

Describe the x-values at which the function is differentiable.

$$f(x) = |x^2 - 16|$$

$(-\infty, -4) \cup (-4, 4) \cup (4, \infty)$

$x \neq \pm 4$ corner

Example

Describe the x-values at which the function is differentiable.

$$f(x) = \frac{2x - 4}{x + 3}$$

$x = -3$

V.A.

$x = -3$

$(-\infty, -3) \cup (-3, \infty)$

infinite discontinuity @ $x = -3$

Attachments

Graphs Differentiablity.tii

Graph 2.1 Limit Tangent Line.tii