

Normal Line at a Point

Find the exact equation of the normal line at the given point on the curve.

1.

$$f(x) = -3 \cdot (3)^{-x+1} - 2$$

$$\text{at } x = -2$$

Find the normal line.

2.

$$f(x) = -2 \cdot x^2$$

$$\text{at } x = 0$$

Find the normal line.

3.

$$f(x) = 3 \cdot \tan(-1 \cdot x) - 1$$

$$\text{at } x = \frac{-1}{6} \cdot \pi$$

Find the normal line.

4.

$$f(x) = \frac{2 \cdot x^2}{-3 \cdot x + 1}$$

$$\text{at } x = 0$$

Find the normal line.

5.

$$f(x) = 3 \cdot (2)^{-\frac{1}{2} \cdot x - 1} - 1$$

$$\text{at } x = 1$$

Find the normal line.

6.

$$f(x) = -x - 3 \cdot x^2 + 3 \cdot x^3$$

$$\text{at } x = -3$$

Find the normal line.

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Normal Line at a Point

Find the exact equation of the normal line at the given point on the curve.

7.

$$f(x) = \csc(-1 \cdot x) - 2$$

$$\text{at } x = \frac{-4}{3} \cdot \pi$$

Find the normal line.

8.

$$f(x) = \frac{3 \cdot x - 3 \cdot x^2 + \frac{1}{2} \cdot x^3 + 3}{-3 \cdot x - x^2 - 2}$$

$$\text{at } x = 1$$

Find the normal line.

Normal Line at a Point

Answer Key

Find the exact equation of the normal line at the given point on the curve.

1. $f(x) = -3 \cdot 3^{-x+1} - 2$
 $f'(x) = 3 \cdot \ln(3) \cdot 3^{-x+1}$
 $f(x_0) = -83$
 $f'(x_0) = 81 \cdot \ln(3)$
 Normal: $(y + 83) = \frac{-1}{81 \cdot \ln(3)}(x + 2)$

All real x.

2. $f(x) = -2 \cdot x^2$
 $f'(x) = -4 \cdot x$
 $f(x_0) = 0$
 $f'(x_0) = 0$
 Normal: $x = 0$

All real x.

3. $f(x) = 3 \cdot \tan(-1 \cdot x) - 1$
 $f'(x) = -3 \cdot \sec(-1 \cdot x)^2$
 $f(x_0) = \sqrt{3} - 1$
 $f'(x_0) = -4$
 Normal: $(y - (\sqrt{3} - 1)) = \frac{1}{4}(x + \frac{1}{6}\pi)$

$\cos(-1 \cdot x) \neq 0$.

4. $f(x) = \frac{2 \cdot x^2}{-3 \cdot x + 1}$
 $f'(x) = \frac{4 \cdot x \cdot (-3 \cdot x + 1) + 6 \cdot x^2}{(-3 \cdot x + 1)^2}$
 $f(x_0) = 0$
 $f'(x_0) = 0$
 Normal: $x = 0$

$-3 \cdot x + 1 \neq 0$ (original denominator).

5. $f(x) = 3 \cdot 2^{-\frac{1}{2} \cdot x - 1}$
 $f'(x) = \frac{-3}{2} \cdot \ln(2) \cdot 2^{-\frac{1}{2} \cdot x - 1}$
 $f(x_0) = 3 \cdot 2^{\frac{-3}{2} - 1}$
 $f'(x_0) = \frac{-3}{2} \cdot \ln(2) \cdot 2^{\frac{-3}{2}}$
 Normal: $(y - (3 \cdot 2^{\frac{-3}{2} - 1})) = \frac{-1}{\frac{-3}{2} \cdot \ln(2) \cdot 2^{\frac{-3}{2}}}(x - 1)$

All real x.

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Normal Line at a Point

Answer Key

Find the exact equation of the normal line at the given point on the curve.

6. $f(x) = -x - 3x^2 + 3x^3$
 $f'(x) = -6x + 9x^2 - 1$
 $f(x_0) = -105$
 $f'(x_0) = 98$
 Normal: $\left(y + 105\right) = \frac{-1}{98}\left(x + 3\right)$

All real x.

7. $f(x) = \csc(-1 - x) - 2$
 $f'(x) = \csc(-1 - x) \cdot \cot(-1 - x)$
 $f(x_0) = -\frac{2}{3}\sqrt{3} - 2$
 $f'(x_0) = \frac{-2}{3}$
 Normal: $\left(y - \left(-\frac{2}{3}\sqrt{3} - 2\right)\right) = \frac{3}{2}\left(x + \frac{4}{3}\pi\right)$

$\sin(-1 \cdot x) \neq 0$.

8. $f(x) = \frac{3x - 3x^2 + \frac{1}{2}x^3 + 3}{-3x - x^2 - 2}$
 $f'(x) = \frac{\left(-6x + \frac{3}{2}x^2 + 3\right)\left(-3x - x^2 - 2\right) - \left(3x - 3x^2 + \frac{1}{2}x^3 + 3\right)\left(-2x - 3\right)}{\left(-3x - x^2 - 2\right)^2}$
 $f(x_0) = \frac{-7}{12}$
 $f'(x_0) = \frac{53}{72}$
 Normal: $\left(y + \frac{7}{12}\right) = \frac{-72}{53}\left(x - 1\right)$

$-3 \cdot x + -1 \cdot (x)^2 + -2 \neq 0$ (original denominator).