1. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = -2x + 2x^2; \qquad P(3, 12)$

2. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = -2 - x - x^2; \qquad P(2, -8)$

3. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = -1 - 2x + 3x^2; \qquad P(-2, 15)$

4. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = 1 - 3x + x^2; \qquad P(1, -1)$

5. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = -1 + x^2; \qquad P(-3, 8)$

6. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = 2 - 3x^2; \qquad P(2, -10)$

7. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = -2 - x + x^2; \qquad P(-3, 10)$

8. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = 3 + x - 3x^2; \qquad P(1, 1)$

9. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = 2 - x - x^2; \qquad P(0, 2)$

10. Find the equation of the normal line to the graph of the given function at the given point:
$f(x) = -2 + 3x - x^2; \qquad P(1, 0)$

Answers:

1. $y = \frac{-1}{10}x + \frac{123}{10}$
2. $y = \frac{1}{5}x + \frac{-42}{5}$
3. $y = \frac{1}{14}x + \frac{106}{7}$
4. $y = 1x + -2$
5. $y = \frac{1}{6}x + \frac{17}{2}$
6. $y = \frac{1}{12}x + \frac{-61}{6}$
7. $y = \frac{1}{7}x + \frac{73}{7}$
8. $y = \frac{1}{5}x + \frac{4}{5}$
9. $y = 1x + 2$
10. $y = -1x + 1$

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Solutions:

1. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x} - 2x + 2x^2 = -2 + 4x$ ◀ Find the first derivative of the function.

$m = f'(3) = -2 + 4(3) = 10$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\dfrac{1}{m} = -\dfrac{1}{10} = \dfrac{-1}{10}$ ◀ Find the slope of the normal line at the given point P.

$y - (12) = \dfrac{-1}{10}[x - (3)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = \dfrac{-1}{10}x + \dfrac{123}{10}$

2. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x} - 2 - x - x^2 = -1 - 2x$ ◀ Find the first derivative of the function.

$m = f'(2) = -1 - 2(2) = -5$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\dfrac{1}{m} = -\dfrac{1}{-5} = \dfrac{1}{5}$ ◀ Find the slope of the normal line at the given point P.

$y - (-8) = \dfrac{1}{5}[x - (2)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = \dfrac{1}{5}x + \dfrac{-42}{5}$

3. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x} - 1 - 2x + 3x^2 = -2 + 6x$ ◀ Find the first derivative of the function.

$m = f'(-2) = -2 + 6(-2) = -14$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\dfrac{1}{m} = -\dfrac{1}{-14} = \dfrac{1}{14}$ ◀ Find the slope of the normal line at the given point P.

$y - (15) = \dfrac{1}{14}[x - (-2)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = \dfrac{1}{14}x + \dfrac{106}{7}$

4. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}1 - 3x + x^2 = -3 + 2x$ ◀ Find the first derivative of the function.

$m = f'(1) = -3 + 2(1) = -1$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\dfrac{1}{m} = -\dfrac{1}{-1} = 1$ ◀ Find the slope of the normal line at the given point P.

$y - (-1) = 1[x - (1)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = 1x + -2$

5. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x} - 1 + x^2 = 2x$ ◀ Find the first derivative of the function.

$m = f'(-3) = 2(-3) = -6$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\dfrac{1}{m} = -\dfrac{1}{-6} = \dfrac{1}{6}$ ◀ Find the slope of the normal line at the given point P.

$y - (8) = \dfrac{1}{6}[x - (-3)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = \dfrac{1}{6}x + \dfrac{17}{2}$

6. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}2 - 3x^2 = -6x$ ◀ Find the first derivative of the function.

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$m = f'(2) = -6(2) = -12$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\frac{1}{m} = -\frac{1}{-12} = \frac{1}{12}$ ◀ Find the slope of the normal line at the given point P.

$y - (-10) = \frac{1}{12}[x - (2)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = \frac{1}{12}x + \frac{-61}{6}$

7. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} - 2 - x + x^2 = -1 + 2x$ ◀ Find the first derivative of the function.

$m = f'(-3) = -1 + 2(-3) = -7$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\frac{1}{m} = -\frac{1}{-7} = \frac{1}{7}$ ◀ Find the slope of the normal line at the given point P.

$y - (10) = \frac{1}{7}[x - (-3)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = \frac{1}{7}x + \frac{73}{7}$

8. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x}3 + x - 3x^2 = 1 - 6x$ ◀ Find the first derivative of the function.

$m = f'(1) = 1 - 6(1) = -5$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\frac{1}{m} = -\frac{1}{-5} = \frac{1}{5}$ ◀ Find the slope of the normal line at the given point P.

$y - (1) = \frac{1}{5}[x - (1)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = \frac{1}{5}x + \frac{4}{5}$

9. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x}2 - x - x^2 = -1 - 2x$ ◀ Find the first derivative of the function.

$m = f'(0) = -1 - 2(0) = -1$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\frac{1}{m} = -\frac{1}{-1} = 1$ ◀ Find the slope of the normal line at the given point P.

$y - (2) = 1[x - (0)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = 1x + 2$

10. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} - 2 + 3x - x^2 = 3 - 2x$ ◀ Find the first derivative of the function.

$m = f'(1) = 3 - 2(1) = 1$ ◀ Find the slope of the tangent line at the given point P.

$m_n = -\frac{1}{m} = -\frac{1}{1} = -1$ ◀ Find the slope of the normal line at the given point P.

$y - (0) = -1[x - (1)]$ ◀ Use the Point-Slope formula: $y - y_1 = m_n(x - x_1)$ ▶ Then simplify:

$\therefore y = -1x + 1$

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