

Equation of a tangent and normal

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Worked example

Find the equation of the tangent to the curve $y = x^4$ when $x = 2$

Your turn

Find the equation of the tangent to the curve $y = x^3$ when $x = 2$

$$y - 8 = 12(x - 2)$$

$$y = 12x - 16$$

Worked example

Find the equation of the normal to the curve $y = x^4$ when $x = 2$

Your turn

Find the equation of the normal to the curve $y = x^3$ when $x = 2$

$$y - 8 = -\frac{1}{12}(x - 2)$$
$$y = -\frac{1}{12}x + \frac{49}{6}$$

Worked example

Find the equation of the tangent to the curve with equation

$y = x^3 - 5x^2 - 3x + 2$ at the point $(5, -13)$

Your turn

Find the equation of the tangent to the curve with equation

$y = x^3 - 3x^2 + 2x - 1$ at the point $(3, 5)$

$$y = 11x - 28$$

Worked example

The tangent to the curve $y = \frac{1}{4}x^3 + x^2 - 3x$ at the point P is parallel to the line with equation $y = -\frac{17}{4}x + 2$. Find the two possible values for the x -coordinate of the point P.

Your turn

The tangent to the curve $y = \frac{1}{5}x^3 - x^2 - x$ at the point P is parallel to the line with equation $y = 4x - 9$. Find the two possible values for the x -coordinate of the point P.

$$x = -\frac{5}{3}, x = 5$$

Worked example

Find the equation of the normal to the curve with equation $y = 3 - 4\sqrt[3]{x}$ at the point where $x = 8$.

Give your answer in the form $ax + by + c = 0$

Your turn

Find the equation of the normal to the curve with equation $y = 8 - 3\sqrt{x}$ at the point where $x = 4$.

Give your answer in the form $ax + by + c = 0$

$$3y - 4x + 10 = 0$$

Worked example

Find the equation of the normal to the curve with equation $y = 3 - 4\sqrt[3]{x}$ at the point where $x = 8$. Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.

Your turn

Find the equation of the normal to the curve with equation $y = 8 - 3\sqrt{x}$ at the point where $x = 4$. Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.

$$3y - 4x + 10 = 0$$

Worked example

The point P with x -coordinate $\frac{1}{4}$ lies on the curve with equation $y = 2x^2$.

The normal to the curve at P intersects the curve at points P and Q .

Find the coordinates of Q

Your turn

The point P with x -coordinate $\frac{1}{2}$ lies on the curve with equation $y = 4x^2$.

The normal to the curve at P intersects the curve at points P and Q .

Find the coordinates of Q

$$\left(-\frac{9}{16}, \frac{81}{64}\right)$$

Worked example

The curve $y = 4x^3 - 7$ intersects the y -axis at C. The tangent to the curve at P(3, 101) intersects the y -axis at D. Work out the length of CD.

Your turn

The curve $y = 2x^3 - 5$ intersects the y -axis at C. The tangent to the curve at P(2, 11) intersects the y -axis at D. Work out the length of CD.

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Worked example

Point B lies on the curve $y = x^3 - 5x + 4$
The x -coordinate of B is -8
Show that the equation of the normal to the curve at B is $187y + x = -87524$

Your turn

Point A lies on the curve $y = x^2 + 5x + 8$
The x -coordinate of A is -4
Show that the equation of the normal to the curve at A is $3y - x = 16$

Shown