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- I really love school
- I enjoy it
- It's OK
- I don't like it
- I hate it and can't wait to finish

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4. Math puzzles
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### [Radius of Curvature interactive graph update](#)

Here's an updated interactive graph where you can explore the concept of radius of curvature....

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## 8. Radius of Curvature

By M. Bourne

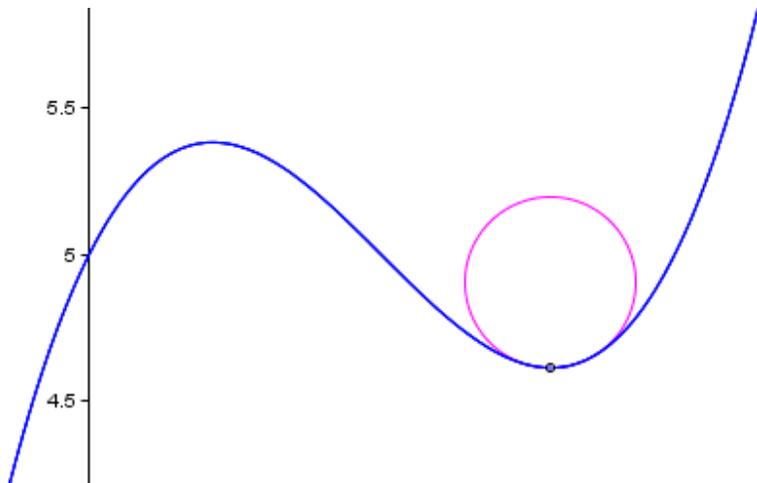
We can draw a circle that closely fits nearby points on a local section of a curve, as follows.

### Application - Radius of Curvature



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When engineers design train tracks, they need to ensure the curvature of the track will be safe and provide a comfortable ride for the given speed of the trains. [Image [source](#)].



The **radius of curvature** of the curve is defined as the radius of the approximating circle. This radius changes as we move along the curve. How do we find this changing radius of curvature?

The formula for the radius of curvature at any point  $x$  for the curve  $y = f(x)$  is given by:

$$\text{Radius of curvature} = \frac{[1 + (\frac{dy}{dx})^2]^{3/2}}{|\frac{d^2y}{dx^2}|}$$

[Proof](#)

## Example 1

### Need Graph Paper?

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Find the radius of curvature for the cubic

$$y = 2x^3 - x + 3$$

at the point  $x = 1$ .

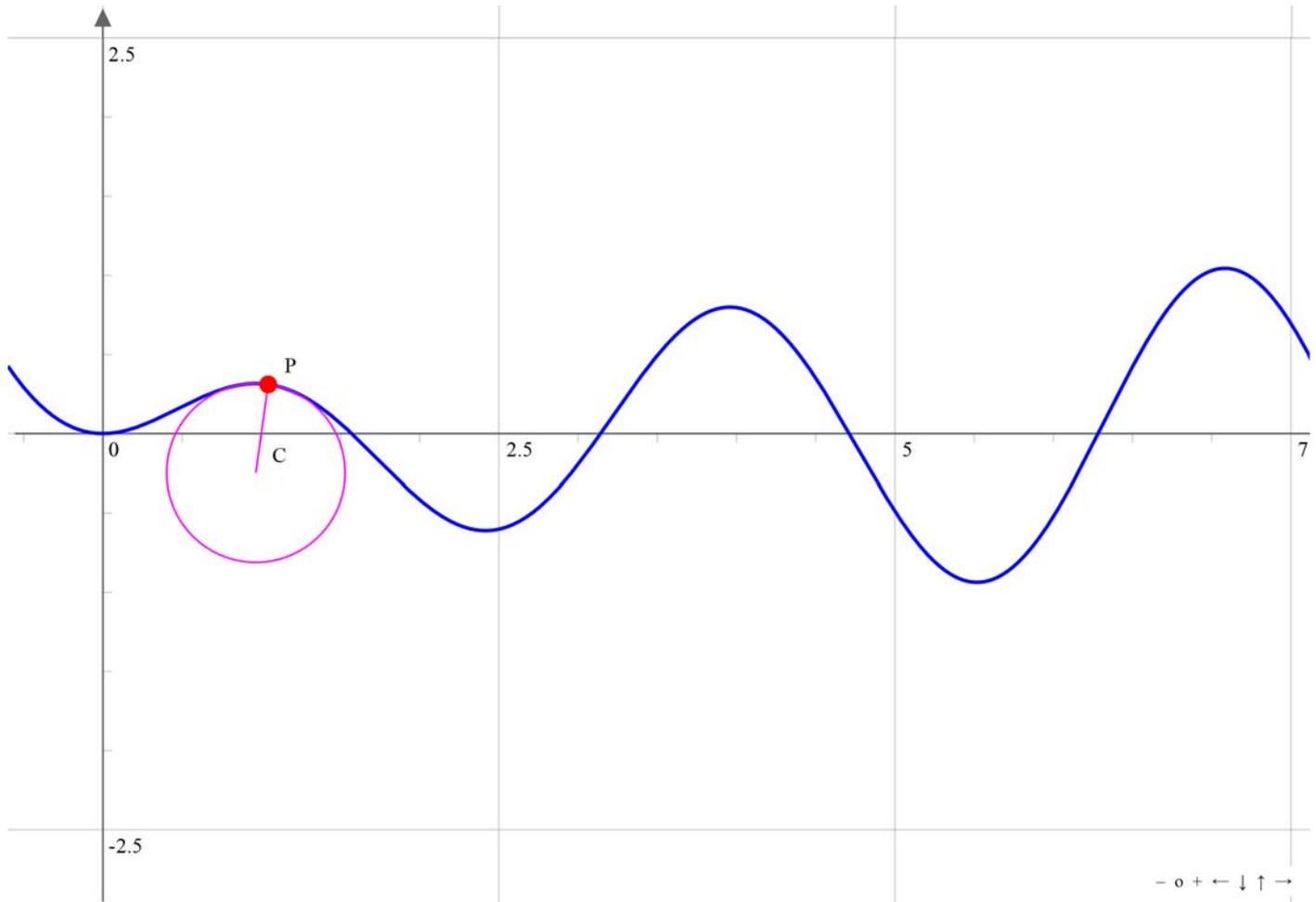
[Answer](#)

### Exploration

In the following interactive graph you can explore what "changing radius of curvature" means.

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**Slowly drag** the point "P" around the curve to see the changing radius of curvature (segment CP). It works best if you use a left-right motion - don't worry about following the up-down of the graph.



You'll notice at the **point of inflexion** there is interesting behavior. The circle changes from being below the curve to above (when moving left to right). When we are right on the point of inflexion, what does the circle become?

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### Example 2

[This example was supplied by a reader.]

We have a curve which is defined by data points and we don't know the function for this data. How can we find the radius of curvature?

We take any 3 data points to illustrate ways of solving this. I chose the points (1, 1), (2, 3) and (3,8).

We'll do this in 3 different ways, just for fun (and for learning about how different math approaches can be used)!

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## Method 1: Approximation Using a Parabolic Fit and Calculus Methods

[Answer](#)

## Method 2: Using Linear Approximations and Calculus Methods

[Answer](#)

## Method 3: Finding the Radius of the Circle through our 3 Points

[Answer](#)

[7. Applied Maximum and Minimum Problems](#)

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