1. Use the definition of the derivative to calculate $f'(1)$ for $f(x) = (x+1)^2$.

2. The position of a particle at time t is given by $s(t) = 2t^2 - 12t + 8$. When is the velocity of the particle equal to zero?

3. Differentiate $f(x) = x^2 \sin x$.

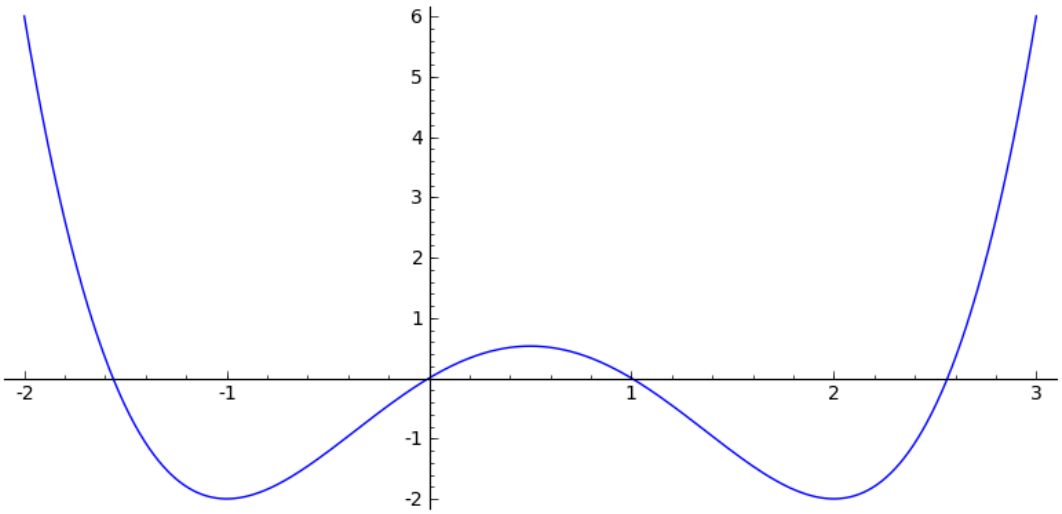
4. Differentiate $f(x) = \sqrt{1+x^3}$.

5. Differentiate $f(x) = \dfrac{x}{\cos x}$.

6. Differentiate $f(x) = \dfrac{1}{(1+x)^{\frac{1}{3}}}$.

7. Calculate the second derivative of $f(x) = \tan x$.

8. The graph $y = f(x)$ is shown. Use this graph to sketch the graph of $f'(x)$ on the same axes. Be as accurate as you can with the x-axis intercepts.



9. Find an equation for the tangent line to the curve $y^2 = x^3 + 3x^2$ (the Tschirnhausen cubic) at the point $(1, -2)$.

10. Find $\frac{dy}{dx}$ if $1 + x = \sin(xy^2)$.

11. Use the linear approximation to $f(x) = \sqrt{x}$ at $x = 9$ to estimate $\sqrt{12}$.

12. A particle in a magnetic field moves along the curve $y = \sin x$. When it reaches the point $\left(\frac{2\pi}{3}, \frac{\sqrt{3}}{2}\right)$ the x-coordinate is increasing at a rate of 6 cm/s. How fast is the y-coordinate increasing (or decreasing) at that instant?

13. A boat is being pulled into dock by a line attached to the bow of the boat and running through a pulley on the dock. The pulley is 5 ft higher than the bow of the boat and the rope is being pulled through the pulley at a rate of 2 ft/s. How fast is the boat approaching the dock when it is 12 ft from the dock? (If you are confused about the situation, please explore the model at the front of the classroom).