

Worksheet 5a
[Derivatives and applications]

1.
 - a. Determine the points on the curve
$$y = 2x^3 - 9x^2 - 24x + 4$$
where the tangent line to the curve is parallel to the x-axis.
 - b. Determine the points on the curve
$$y = 3x^4 - 2x^3 - 9x^2 + 1$$
where the tangent line to the curve is parallel to the x-axis.
 - c. Find the equation of the tangent and normal lines to the curve
$$y = x + \frac{1}{\sqrt{x}}$$
at the point where $x = 4$.
 - d. Find the equation of the tangent and normal lines to the curve
$$y = x^4 + 2x^3 + x^2 + x + 1$$
at the point where the tangent line has slope equal to 1.
 - e. Find the equation of the tangent and normal lines to the curve
$$y = 3x^4 + 4x^3 - 12x^2 - 22x + 1$$
at the points on the curve where the tangent line is parallel to the straight line $y = 2x - 5$
2. Use the definition of the derivative as a limit to determine $f'(x)$ given that
 - a. $f(x) = \sqrt{x^2 + 4}$
 - b. $f(x) = \frac{1}{x^2 - 4}$
 - c. $f(x) = \frac{4x + 5}{3 - 5x}$
 - d. $f(x) = \frac{1}{\sqrt{4 - x^2}}$

In each case check your answer by using the rules for differentiation.

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3. In each case, determine $f'(x)$.
- $f(x) = \sin(x^4 + x^3)$
 - $f(x) = \tan(\sqrt{4 - x^3})$
 - $f(x) = \sec(x^{2/3} - x)$
 - $f(x) = \csc(\sqrt{x^4 + 1})$
 - $f(x) = \cos(\cos(\cos x))$
 - $f(x) = \cot(\sin(x^3 + 1))$
 - $f(x) = \sqrt{\sqrt{x^2 + \sqrt{x^2 + \sqrt{x^2 + 1}}}}$
4. Determine all points on each graph of the function given where the tangent line is parallel to the x-axis.
- $y = x^4 - x^2 + 1$
 - $y = \sin 2x - 2 \sin x$
 - $y = \tan x + \cot x$
5. Determine whether or not the given curve has a tangent line which is parallel to the x-axis:
- $y = 2x^3 + 3x^2 + 6x + 12$
 - $y = 2x^3 - x^2 + 2x - 1$