

## Set 016 Derivative Tests

[1 - 10] For each function,

(a) find  $f'(x)$ ;

(b) find where  $f'(x)$  is zero or undefined;

(c) construct a sign line for  $f'(x)$ ;

(d) state where the graph of  $f$  is increasing and where it has extrema, identifying the type of each extremum.

[1]  $f(x) = 3x^2 - 5x + 2$

[2]  $f(x) = x^3 + 3x^2 - 4$

[3]  $f(x) = x^3 - 4x^2 - 3x + 18$

[4]  $f(x) = \sin^2 x, 0 \leq x \leq 2\pi$

[5]  $f(x) = xe^x$

[6]  $f(x) = \frac{e^x}{x}$

[7]  $f(x) = \frac{x^2 + 1}{x + 1}$

[8]  $f(x) = e^x \sin x, 0 \leq x \leq \pi$

[9]  $f(x) = \frac{(x-1)^2}{x+1}$

[10]  $f(x) = x^{\frac{2}{3}}$

[11 - 19] For each function,

(a) find  $f''(x)$ ;

(b) find where  $f''(x)$  is zero or undefined;

(c) construct a sign line for  $f''(x)$ ;

(d) state where the graph of  $f$  is concave up and where it has flex points.

[11]  $f(x) = x - 2x^2$

[12]  $f(x) = x^3 + 6x^2 - x + 3$

[13]  $f(x) = x^4 - 24x^2 + 5x - 10$

[14]  $f(x) = \cos x, 0 \leq x \leq 2\pi$

[15]  $f(x) = x^2 e^x$

[16]  $f(x) = \frac{x+2}{x-3}$

[17]  $f(x) = \frac{x^2 + 1}{x^2 - 1}$

[18]  $f(x) = \frac{e^x}{x}$

[19]  $f(x) = x^{\frac{2}{3}}$

[20] Consider the graph of  $x^2 + 3xy + y^2 = 5$ .

[a] Determine whether the graph is increasing or decreasing at  $(1, 5)$ .

[b] Determine whether the graph is concave up or down at  $(1, 5)$ .

[c] Determine whether the graph is increasing or decreasing at  $(0, -\sqrt{5})$ .

[d] Determine whether the graph is concave up or down at  $(0, -\sqrt{5})$ .

[21] Consider the graph of  $xe^y + y = 2 + \ln 2$ .

[a] Determine whether the graph is increasing or decreasing at  $(1, \ln 2)$ .

[b] Determine whether the graph is concave up or down at  $(1, \ln 2)$ .