



CAMI Mathematics: Grade 12

12.5 Calculus

12.5 Differentiation rules

1. The derivative of a function

- (a) Determine $f'(x)$ if $f(x) = -7x - 4$.
- (b) Determine $\frac{df(x)}{dx}$ if $f(x) = 5$.
- (c) Determine $D_x[f(x)]$ if $f(x) = -9x - 3$.
- (d) Determine $f'(x)$ if $f(x) = x$.
- (e) Determine $D_x[f(x)]$ if $f(x) = -5x + 8$.

2. The derivative of a function

- (a) Determine $f'(x)$ if $f(x) = -6x^3 - 4x^2 + 2x$.
- (b) Determine $D_x[f(x)]$ if $f(x) = 5x^3 - x$.
- (c) Determine $\frac{df(x)}{dx}$ if $f(x) = x^3 - 5x^2 + 6$.
- (d) Determine $f'(x)$ if $f(x) = 3x^3 - x^2 + 8x + 4$.
- (e) Determine $D_x[f(x)]$ if $f(x) = 3x^3 + 6x$.

3. Determine $f'(x)$ of the following functions.

- (a) $f(x) = \frac{9}{x}$
- (b) $f(x) = \frac{4}{7x^7}$
- (c) $f(x) = \frac{-6}{x^6}$



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(d) $f(x) = \frac{x-1}{\sqrt{x}}$

(e) $f(x) = \frac{12x^2 - 4x - 21}{6x + 7}$

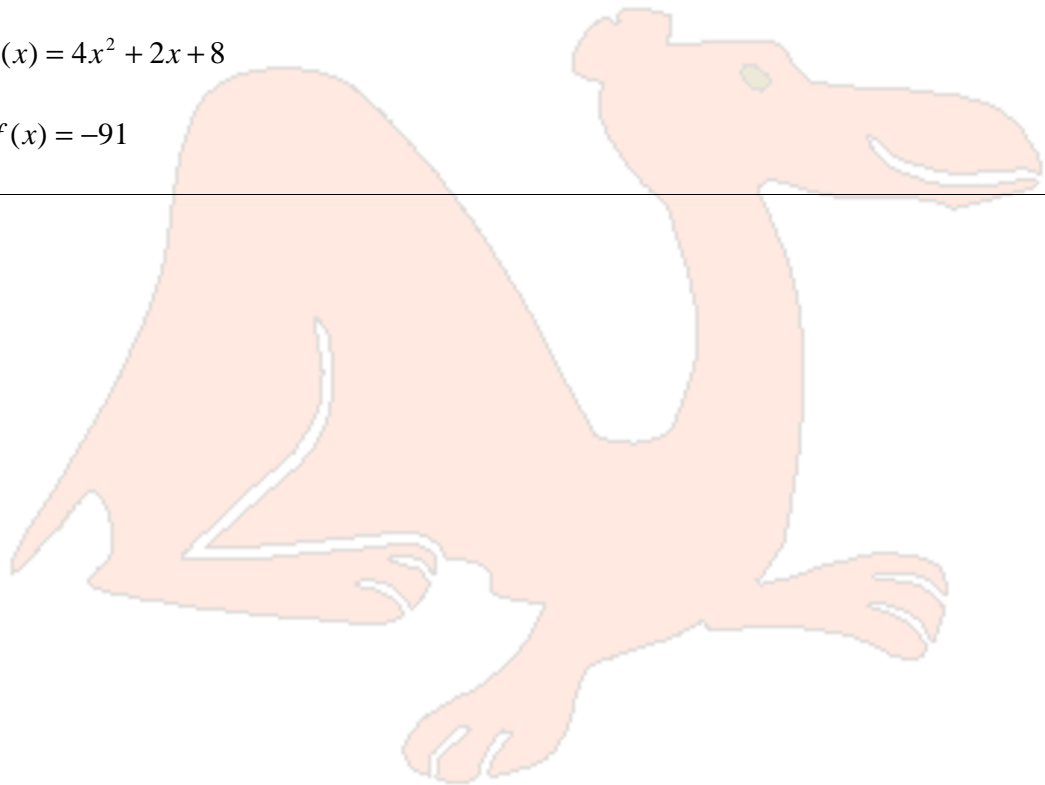
(f) $f(x) = \frac{x^6 + x^4 + 1}{x}$

(g) $f(x) = -x^3 - 5x^2 - 2x - 7$

(h) $f(x) = x^{-6}$

(i) $f(x) = 4x^2 + 2x + 8$

(j) $f(x) = -91$





MEMO

1. The derivative of a function [5.6.4.3]

(a) $f(x) = -7x - 4$
 $f'(x) = -7$

(b) $f(x) = 5$
 $\frac{df(x)}{dx} = 0$

(c) $f(x) = -9x - 3$
 $D_x[f(x)] = D_x[-9x - 3] = -9$

(d) $f(x) = x$
 $f'(x) = 1$

(e) $f(x) = -5x + 8$
 $D_x[f(x)] = D_x[-5x + 8] = -5$

2. The derivative of a function [5.6.4.4]

(a) $f(x) = -6x^3 - 4x^2 + 2x$
 $f'(x) = -18x^2 - 8x + 2$

(b) $f(x) = 5x^3 - x$
 $D_x[f(x)] = D_x[5x^3 - x] = 15x^2 - 1$

(c) $f(x) = x^3 - 5x^2 + 6$
 $\frac{df(x)}{dx} = 3x^2 - 10x$

(d) $f(x) = 3x^3 - x^2 + 8x + 4$
 $f'(x) = 9x^2 - 2x + 8$

(e) $f(x) = 3x^3 + 6x$
 $D_x[f(x)] = D_x[3x^3 + 6x] = 9x^2 + 6$



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3. Determine $f'(x)$ of the following functions. [5.6.4.5; 5.6.4.6; 5.6.4.7]

(a) $f(x) = \frac{9}{x}$
 $f(x) = \frac{9}{x} = 9x^{-1}$
 $f'(x) = -9x^{-2}$
 $f'(x) = \frac{-9}{x^2}$

(b) $f(x) = \frac{4}{7x^7}$
 $f(x) = \frac{4}{7x^7} = \frac{4}{7}x^{-7}$
 $f'(x) = \frac{4}{7} \cdot (-7)x^{-8}$
 $f'(x) = -4x^{-8}$
 $f'(x) = \frac{-4}{x^8}$

(c) $f(x) = \frac{-6}{x^6}$
 $f(x) = \frac{-6}{x^6} = -6x^{-6}$
 $f'(x) = -6 \cdot (-6)x^{-7}$
 $f'(x) = 36x^{-7}$
 $f'(x) = \frac{36}{x^7}$

(d) $f(x) = \frac{x-1}{\sqrt{x}}$
 $f(x) = \frac{x-1}{\sqrt{x}} = \frac{x}{\sqrt{x}} - \frac{1}{\sqrt{x}}$
 $f(x) = x^{\frac{1}{2}} - x^{-\frac{1}{2}}$

$$f'(x) = \frac{1}{2}x^{-\frac{1}{2}} + \frac{1}{2}x^{-\frac{3}{2}}$$



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(e) $f(x) = \frac{12x^2 - 4x - 21}{6x + 7}$

$$f(x) = \frac{12x^2 - 4x - 21}{6x + 7} = \frac{(6x + 7)(2x - 3)}{(6x + 7)} = 2x - 3$$

$$f'(x) = 2$$

(f) $f(x) = \frac{x^6 + x^4 + 1}{x}$

$$f(x) = \frac{x^6 + x^4 + 1}{x} = x^5 + x^3 + x^{-1}$$

$$f'(x) = 5x^4 + 3x^2 - x^{-2}$$

(g) $f(x) = -x^3 - 5x^2 - 2x - 7$

$$f'(x) = -3x^2 - 10x - 2$$

(h) $f(x) = x^{-6}$

$$f'(x) = -6x^{-7}$$

(i) $f(x) = 4x^2 + 2x + 8$

$$f'(x) = 8x + 2$$

(j) $f(x) = -91$

$$f'(x) = 0$$