Derivative

Name

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ANSWERS

1a

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2b

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4a

4b

5a

5b

1) Find the derivative of the given functions.

a) $y = \dfrac{x^3 - 1}{x^3 + 1}$

b) $y = x^3 \cdot \cos x - 2 \cdot \sin x$

2) **a)** $f(x) = 10 \cdot \ln(\frac{1}{5}x) \quad \Rightarrow \quad f'(\frac{5}{3}) = ?$

b) $f(x) = 2\sqrt{2} \cdot \sin^3 x \quad \Rightarrow \quad f'(\frac{\pi}{4}) = ?$

3) **a)** Position of a particle is given by the equation $S(t) = \frac{1}{4}t^4 - \frac{2}{9}t^3 + 5t^2 + 10$.
Find the velocity of this particle at $t = 3$.

b) If $f(x) = 2x^4 - x^2$, then solve the equation $f'(x) = 0$ and solve the inequality $f'(x) \le 0$.

4) **a)** Find the slope of the line that is tangent to the function $y = \sin\frac{2x}{3}$ at $x = \frac{3\pi}{2}$.

b) A particle is thrown up with the initial velocity v_0.

The altitude changes with respect to time as $h(t) = v_0.t - \dfrac{g.t^2}{2}$.

If $v_0 = 60m/s$ and $g = 10m/s^2$, then calculate h_{max}.

5) **a)** Examine the extremum points, and monotonicity of the function $y = \frac{2}{3}x^3 + x^2 - 12x.$

b) Find the minimum and maximum values of the function $y = x^3 + 3x$ in the interval $[0,2]$.

A

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B

Find the derivatives of the given functions:

1a. $y = \dfrac{1}{(6x+1)^2}$

1b. $y = \dfrac{4}{(8-5x)^2}$

2a. $y = \dfrac{x+\sin x}{x-\sin x}$

2b. $y = \dfrac{x-\cos x}{x+\cos x}$

3a. $f(x) = 2tg(2x+3) + \sin x \cos x$

3b. $f(x) = \dfrac{1}{2}ctg(3-2x) - \sin x \cos x$

Calculate

4a. If $f(x) = (x^2 - 3x + 1)e^x$ then $f'(0) = ?$

4b. If $f(x) = \sin x e^x$ then $f'(0) = ?$

5a. If $y = 3^{4x}\log_3(2x)$ then $y'\left(\dfrac{1}{2}\right) = ?$

5b. If $y = 2^{5x}\log(2x)$ then $y'(1) = ?$

6a. If $f(x) = \log_3\left(x^2 - 2\sqrt{x}\right)$ then $f'(4) = ?$

6b. If $f(x) = \log_2\left(\sqrt[3]{2-3x}\right)$ then $f'(1) = ?$

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1a. If $f(x) = \sin 2x + 2x$, then solve the equation $f'(x) = 0$ and the inequality $f'(x) > 0$.

1b. If $f(x) = \cos 6x - 3x$, then solve the equation $f'(x) = 0$ and the inequality $f'(x) < 0$.

2a. If $f(x) = \dfrac{x^2 + 8}{x + 1}$, then solve the equation $f'(x) = 0$ and the inequality $f'(x) < 0$.

2b. If $f(x) = \dfrac{x^2 - 12}{x - 2}$, then solve the equation $f'(x) = 0$ and the inequality $f'(x) > 0$

3a. If $f(x) = 16 \ln x - 2x^2$, then solve the inequality $f'(x) \geq 0$.

3b. If $f(x) = x^2 - 2 \ln x$, then solve the inequality $f'(x) \leq 0$.

4a. If $f(x) = e^{-1-x} + \lg e^x$, then compare $f'(-1)$ and zero.

4b. If $f(x) = \dfrac{2^{1-2x}}{x^{-3}}$, then compare $f'(1)$ and zero.

B

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Find the slope of the lines that are tangent to the functions at the given points:

1 a. $f(x)=\sqrt[3]{x^2}-\frac{1}{x}+3 \quad , \quad x_0=1$

1 b. $f(x)=\frac{1}{8}x^3+\sqrt{x}-5x \quad , \quad x_0=4$

2 a. $y=\frac{4}{3}\left(\frac{x-1}{x+2}\right)^2 \quad , \quad x_0=1$

2 b. $y=\frac{1}{2}\left(\frac{x+1}{x-2}\right)^2 \quad , \quad x_0=0$

3 a. At which point on the curve $y=x^3$ is the slope of the tangent line equal to 3?.

3 b. At which point on the curve $y=\sqrt{x}$ is the angle between the tangent line and the x-axis equal to 45°?

4 a. Find the equation of the line which is parallel to the line $y=1-3x$ and passing through the point $M(3;-1)$.

4 b. Find the equation of line which is perpendicular to the line $y=2+3x$ and passing through the point $M(2;-4)$.

Write the equation of lines which are tangent to the functions at the given points.

5 a. $f(x)=\frac{x+2}{3-x} \quad , \quad x_0=2$

5 b. $f(x)=\frac{1-x}{x+4} \quad , \quad x_0=-3$

6 a. $f(x)=\log_3 x \quad , \quad x_0=1$

6 b. $f(x)=\log_2(x+1) \quad , \quad x_0=1$

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1a. Find the equation of tangent of the curve $y = x^3$ which is perpendicular to the line $y = -\frac{1}{3}x + \frac{4}{3}$.

1b. Find the equation of tangent of the curve $y = \frac{4}{x}$ which is parallel to the line $y = -x + 1$.

Examine the intervals of increasing ,decreasing and extremum for the given functions

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

2b. $f(x) = \frac{1}{(x-3)^2}$

3a. $f(x) = \frac{1}{2}x^4 - \frac{5}{3}x^3 - \frac{3}{2}x^2 + 5$

3b. $f(x) = \frac{1}{2}x^4 + x^3 - x^2 + 3$

4a. Prove that $y = xe^{2x-1}$ is increasing in the interval $(-0,5;+\infty)$

4b. Prove that $y = \frac{e^{1-x}}{x}$ is decreasing in the interval $(0;+\infty)$

Find the maximum and minimum value of the given functions in the given intervals.

5a. $y = \sin x + \cos x$, $\left[0; \frac{\pi}{2}\right]$

5b. $y = \cos x - \sin x$, $\left[\frac{3\pi}{2}; 2\pi\right]$

6a. $f(x) = \frac{3^x + 3^{2-x}}{\ln 3}$, $[-1;2]$

6b. $f(x) = 3^{2x} + 2.3^x$, $[0;2]$

A