AP Calculus - #012122 - - - > NO CALCULATOR < - - -

Differentiate each function with respect to the given variable.

1) $g(x) = (-x^5 + 3)^2$

2) $h(s) = (5s^5 + 3)^5$

3) $t = (3r + 5)^4$

4) $r = (x^4 + 3)^2$

For each problem, use implicit differentiation to find $\frac{dy}{dx}$ in terms of x and y.

5) $2x^2 - 3y^3 = 5$

6) $2x^3 = -3y + 2xy$

7) $3x - 2x^3y^2 = 4y^2$

8) $3 = 2x^3 - 4y^3$

Differentiate each function with respect to x.

9) $y = \sin 3x^4$

10) $y = \tan 4x^3$

11) $y = \cos(\sin 5x^2)$

12) $y = \cos(\tan 3x^2)$

Evaluate each definite integral.

13) $\int_{2}^{5} \left(-x^2 + 4x + 1\right) dx$

14) $\int_{-3}^{0} \left(x^3 + 4x^2 + 4x - 1\right) dx$

15) $\int_{3}^{4} \left(x^3 - 10x^2 + 33x - 33\right) dx$

16) $\int_{-1}^{2} \left(-x^2 + 2x + 4\right) dx$

For each problem, find the open intervals where the function is increasing and decreasing.

17) $y = -x^2 + 4x - 6$

18) $y = x^2 + 2x - 5$

A particle moves along a horizontal line. Its position function is $s(t)$ for $t \geq 0$. For each problem, find the times t when the particle changes directions and the times t when the acceleration is 0.

19) $s(t) = -t^3 + 13t^2$

20) $s(t) = -t^3 + 9t^2$

Answers to

1) $g'(x) = -10x^4(-x^5 + 3)$

2) $h'(s) = 125s^4(5s^5 + 3)^4$

3) $\frac{dt}{dr} = 12(3r + 5)^3$

4) $\frac{dr}{dx} = 8x^3(x^4 + 3)$

5) $\frac{dy}{dx} = \frac{4x}{9y^2}$

6) $\frac{dy}{dx} = \frac{-2y + 6x^2}{-3 + 2x}$

7) $\frac{dy}{dx} = \frac{-3 + 6x^2y^2}{-4yx^3 - 8y}$

8) $\frac{dy}{dx} = \frac{x^2}{2y^2}$

9) $\frac{dy}{dx} = \cos 3x^4 \cdot 12x^3$
$= 12x^3 \cos 3x^4$

10) $\frac{dy}{dx} = \sec^2 4x^3 \cdot 12x^2$
$= 12x^2 \sec^2 4x^3$

11) $\frac{dy}{dx} = -\sin(\sin 5x^2) \cdot \cos 5x^2 \cdot 10x$
$= -10x \sin(\sin 5x^2) \cos 5x^2$

12) $\frac{dy}{dx} = -\sin(\tan 3x^2) \cdot \sec^2 3x^2 \cdot 6x$
$= -6x \sin(\tan 3x^2) \sec^2 3x^2$

13) 6

14) $-\frac{21}{4} = -5.25$

15) $\frac{35}{12} \approx 2.917$

16) 12

17) Increasing: $(-\infty, 2)$ Decreasing: $(2, \infty)$

18) Increasing: $(-1, \infty)$ Decreasing: $(-\infty, -1)$

19) Changes direction at: $t = \left\{\frac{26}{3}\right\}$
Acceleration zero at: $t = \left\{\frac{13}{3}\right\}$

20) Changes direction at: $t = \{6\}$
Acceleration zero at: $t = \{3\}$