AP Calc AB Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 WS Assessment

 Target 9:

Calculating high order derivative

**I can:**

* Determine higher order derivative of a function
* Select an appropriate procedure for calculating derivative

Unit 3: Differentiation: Composite, Implicit, and Inverse Functions

HW Target 9

Unit 3 Progress Check FRQ A and B

Higher Order Derivatives

Because the derivative of a function *y* = *f*( *x*) is itself a function *y′* = *f′*( *x*), you can take the derivative of *f′*( *x*), which is generally referred to as the *second derivative of f(x)* and written *f′′* ( *x*) or *f* 2( *x*). This differentiation process can be continued to find the third, fourth, and successive derivatives of *f*( *x*), which are called **higher order derivatives** of *f*( *x*). Because the “prime” notation for derivatives would eventually become somewhat messy, it is preferable to use the numerical notation *f*( *n*)( *x*) = *y*( *n*) to denote the *n*th derivative of *f*( *x*).

Find the first, second, and third derivatives of *f*( *x*) = 5 *x* 4 − 3x 3 + 7x 2 − 9x + 2.

Find the first, second, and third derivatives of *y* = sin 2 *x*.

Find *f* (3) (4) if $f\left(x\right)=\sqrt{x}$

To differentiate parametric equations, we must use the chain rule.

 If x = 2at2 and y = 4at, find dy/dx



 Finding the second derivative is a little trickier. Use

Find the tangent line(s) to the parametric curve given by x = t5 – 4t3 ; y = t2 (graph) at (0,4). Then find its second derivative.

Given    x(t) = t3   y(t) = t4   Find its first and second derivative

Now that we’ve found some higher order derivatives we should probably talk about an interpretation of the second derivative.

If the position of an object is given by s(t) we know that the velocity is the first derivative of the position. v(t) = s′(t)

The acceleration of the object is the first derivative of the velocity, but since this is the first derivative of the position function we can also think of the acceleration as the second derivative of the position function. a(t) = v′(t) = s′′(t)

Derivative Practice

Take derivative of the following function f(x)

1. 4x3 – 3x2 + 2x + e 2. $\frac{x^{2}}{3}-\frac{3}{x^{2}}$ 3. -3(2x2 -5x + 1)

4. $\sqrt{x}-\frac{1}{\sqrt{x}}$ 5. $\frac{x+1}{x-2}$ 6. $\frac{x^{2}-2}{x^{2}}$

7. $\sqrt{x}(x^{2}+1)$ 8. $\frac{x^{2}}{x^{2}-2}$ 9. $\frac{e^{x}}{e^{x}-1}$

10. $\frac{2}{\sqrt{x}}+\frac{\sqrt{x}}{2}$ 11. $\frac{2x}{x-1}$ 12. (3x -2)(2x + 1)

13. $5x^{2}-5\sqrt{x}-\frac{3}{x}$ 14. $\frac{\sqrt{x}}{\sqrt{x}-1}$ 15. $\frac{e^{x}}{x}$

16. $6x^{\frac{-3}{2}}+7x^{\frac{1}{5}}+1$ 17. $\frac{-7}{1-x^{3}}$ 18. $\frac{4}{3}x^{\frac{3}{4}-π}$

19. $\frac{1}{7x}$ 20. $2x^{\frac{1}{x}-e}$ 21. $e^{lnx^{2}}-3x^{-7}$

22. (3x2 – 4)5 23. 3x2 (23x) 24. e2x – 1 (3x + 4)3

25. $\frac{e^{x^{2}}}{(2x-1)^{3}}$ 26. (e2x + x)(3x2 – 2x + x)4 27. $\frac{(2-3x^{2})^{5}}{5x}$

28. $cos^{3}(\sqrt{x})$ 29. $\left(\frac{cos(x)}{1-sin(x)}\right)^{2}$ 30. (17x2 – 5x)50

31. e2x(sin(3x)) 32. $\sqrt{sin(x)}$ 33. $\frac{tan(x)}{x^{2}-1}$

34. arcsin(x2) 35. (x2 + 1) arctan(x) 36. [arccos(x)]4

37. tan(6x) 38. $\frac{sin2x}{cos2x}$ 39. 5x + 3x7

40. $\frac{sinx}{x^{2}}$ 41. $tan(sinx)+\frac{1}{π}$ 42. 3 cos(5x) + 3sin(x9)

43. sin3(3x2 – 2x + 1) 44. $x^{2}tan\left(\frac{1}{x}\right)$ 45. $sin^{2}\sqrt{x}$

46. e3x cos(2x) 47. [arcsin(x3)]4 48. tan(6x2 – 1)

49. sin(3x)ex 50. $\frac{sec^{2}x-tan^{2}x}{x^{3}}$ 51. $\frac{cosx}{x^{3}}$

52. sin(sin(4x)) + 1/e 53. cos2 (3x2 – 7x) 54. $x^{3}sin\left(\frac{1}{x}\right)$

55. $cos^{4}\sqrt{x}$ 56. $\frac{tanx}{2x-1}$ 57. $\sqrt[3]{sinx-1}$

58. $\frac{4}{x}3^{x^{2}-x}$ 59. $(sinx)e^{3x}+π^{2}$ 60. $\frac{π}{e^{x}+e^{-x}}$

61. $\frac{1}{7}cosx+\frac{1}{6}sinx$ 62. $\frac{csc^{2}x-cot^{2}x}{x}$ 63. $\frac{cos(9x)}{sin(9x)}$

64. $sin(tanx)+\frac{1}{37}$ 65. $4x^{5}tan\left(\frac{-1}{x}\right)$ 66. arcsin (x2)

67. [arccos(x)]3 68. arctan(ex) 69. arctan(-5x)

70. arccos(x3) 71. 2y = x2 + sin y 72. 3y = x3 + cos y

Assessment

 Find y′′  for x2 + y4 = 10

Determine the (x,y) coordinates of the points where the following parametric equations will have horizontal or vertical tangents. x = t3 −3t y = 3t2 – 9 . Sketch