201-SH2-AB - Exercises #12 - Higher Derivatives

Evaluate the higher derivative at the given x-value.

(1) Given $y = 5x^4 - 4x^5 + 6x + 10$, find $\dfrac{d^3y}{dx^3}$ at $x = -2$

(2) Given $y = \dfrac{x^2+2}{x}$, find $\dfrac{d^2y}{dx^2}$ at $x = 1$

(3) Given $y = \left(2x^3 - 5\right)\left(6x^2 + 4x\right)$, find $\left.\dfrac{d^3y}{dx^3}\right|_{x=2}$

(4) Given $y = x^{-4} + 2\sqrt{x}$, find $y'''(1)$

(5) Given $y = \dfrac{3-x^2}{x}$, find $\dfrac{d^2y}{dx^2}$ at $x = 2$

(6) Given $y = \dfrac{x+2}{(x+1)^2}$, find $\dfrac{d^3y}{dx^3}$ at $x = -2$

(7) Given $y = x^{-5} + 2x^3 - x^{1/5}$, find $\dfrac{d^3y}{dx^3}$ at $x = -1$

(8) Given $y = (x + \sqrt{x})(2x + 1)$, find $y''(4)$

(9) Given $y = \dfrac{3x^2 - 5x}{2x^3}$, find $\dfrac{d^2y}{dx^2}$ at $x = 3$

(10) Given $y = \dfrac{2x - 3\sqrt{x}}{4\sqrt{x}}$, find $\dfrac{d^2y}{dx^2}$ at $x = 1$

(11) Given $y = 8x^5 - 12x^6 - 5x + 10$, find $y'''(-1)$

(12) Given $y = \dfrac{2x+7}{3x}$, find $y''(-1)$

(13) Given $y = \left(3x^2 + 4x\right)\left(x^3 - 5\right)$, find $\dfrac{d^3y}{dx^3}$ at $x = 1$

(14) Given $y = \dfrac{4x+5}{6x}$, find $y''(3)$

(15) Given $y = x^{-3} - 3\sqrt{x}$, find $y'''(4)$

(16) Given $y = \dfrac{x-3}{(x-1)^2}$, find $\dfrac{d^3y}{dx^3}$ at $x = -2$

(17) Given $y = x^{-4} - 3x^2 + x^{1/3}$, find $\dfrac{d^3y}{dx^3}$ at $x = 1$

(18) Given $y = \dfrac{2\sqrt{x} - 5x}{3\sqrt{x}}$, $\dfrac{d^2y}{dx^2}$ at $x = 1$

(19) Given $y = \dfrac{4x^3 + 3x}{3x^2}$, find $\dfrac{d^2y}{dx^2}$ at $x = -3$

(20) Given $y = (3x - 1)(2x + \sqrt{x})$, find $y''(1)$

Find the higher derivative:

(21) $y = xe^{2x}$ find $\dfrac{d^3y}{dx^3}$

(22) $y = x\ln(x)$ find $\dfrac{d^3y}{dx^3}$

(23) $y = \dfrac{2x}{e^x}$ find $\dfrac{d^3y}{dx^3}$

(24) $y = \dfrac{\ln(x)}{3x}$ find $\dfrac{d^3y}{dx^3}$

(25) $y = \left(x^2 + 4\right)e^x$ find $\dfrac{d^3y}{dx^3}$

(26) $y = \left(x^2 + 1\right)\ln(x)$ find $\dfrac{d^3y}{dx^3}$

(27) $y = \dfrac{\ln(\sqrt{x})}{x^2}$ find $\dfrac{d^3y}{dx^3}$

(28) $y = \ln\left(e^x + 3\right)$ find $\dfrac{d^3y}{dx^3}$

(29) $y = e^{\sqrt{x}+1}$ find $\dfrac{d^2y}{dx^2}$

(30) $y = \ln\left(\sqrt{x^3+3}\right)$ find $\dfrac{d^2y}{dx^2}$

(31) $y = \dfrac{3\sqrt{x^3} - 2x^3e^{4x}}{2x^3}$ find y''

(32) $y = \sqrt{x^2+1}$ find y''

(33) $y = \sqrt{5x+2}$ find y'''

(34) $g(x) = \dfrac{3x^5 + x^4 + x - x^3e^{3x}}{x^2}$ find $g''(x)$

(35) Find $\dfrac{d^4y}{dx^4}$ if $y = \cos(9 - 3x)$

(36) Find y''' if $y = \cos\left(\dfrac{x}{3}\right)$

(37) Find $\dfrac{d^2y}{dx^2}$ if $y = \ln(\cos(3x))$

(38) Find y'' if $y = \ln\left(\sin^3(x)\right)$

(39) Find y'' if $y = e^{\cos(2x)-1}$

(40) Find y'' if $y = 3x\sin(2x)$

(41) Find $\dfrac{d^2y}{dx^2}$ if $y = \sin(2\ln(x))$

(42) Find y'' if $y = (2x - 1)\cos(3x)$

(43) Find y'' if $y = \dfrac{\sin(x) + 3}{\sin(x) + 4}$

(44) Find $\dfrac{d^2y}{dx^2}$ if $y = \ln(\sin(5x))$

(45) Find $\left.\dfrac{d^2y}{dx^2}\right|_{x=0}$ if $y = \ln\left(\cos^2(2x)\right)$

(46) Find y''' if $y = \sin\left(\dfrac{x}{2}\right)$

Find the higher derivative.

(47) Given $f(x) = x^6 - x^3 + e^{5x} + 2x - 8$, find $f^{(4)}(x)$

*(48) Given $f(x) = e^{2x} + 23x^{37} - 15x^{21} + 7x^{13} - 12x^4$, find $f^{(37)}(x)$

*(49) Given $f(x) = 4x^{21} - 3x^{15} + 164x^7 + \dfrac{1}{x} + e^{-3x}$, find $f^{(47)}(x)$

*(50) Given $f(x) = e^{4x-5} + 4x^{43} + 56x^{34} - \dfrac{1}{x+2}$, find $f^{(45)}(x)$

(51) Given $f(x) = 40x^{57} - 34x^{43} + x^{22} - e^{6-x} + \pi$, find $f^{(61)}(x)$

*(52) Given $f(x) = (x + 2)e^x - x^{29} + x^{15} + x^4 - x^2$, find $f^{(29)}(x)$

*(53) Given $f(x) = 4xe^{x+4} + \dfrac{4}{x}$, find $f^{(84)}(x)$

(54) Given $f(x) = \sin(x)$, find $f^{(81)}(x)$

(55) Given $f(x) = \cos(2x - 5)$, find $f^{(54)}(x)$

(56) Given $f(x) = \sin(3x + 1)$, find $f^{(75)}(x)$

(57) Given $f(x) = \cos(3 - 2x)$, find $f^{(124)}(x)$

(58) Given $f(x) = \sin(1 - 6x)$, find $f^{(45)}(x)$

*(59) Given $f(x) = x\sin(x)$, find $f^{(51)}(x)$

*(60) Given $f(x) = x^{10} + 7x^7 - 3x^3 + 5$, find $f^{(10)}(x)$

(61) Given $f(x) = 2x^{23} + 17x^{15} - 6x^{11}$, find $f^{(30)}(x)$

*(62) Given $f(x) = \dfrac{-2}{x^3}$, find $f^{(51)}(x)$

(63) Given $f(x) = e^{-5x} + x^2$, find $f^{(101)}(x)$

(64) Given $f(x) = 7^{5-2x} + ex^4 - \cos(-\frac{x}{2})$, find $f^{(5)}(x)$

(65) Given $f(x) = 3e^{-x} - \sin 3x + x^{140} - 8$, find $f^{(1007)}(x)$

ANSWERS:

(1) -1200 (2) 4 (3) 3264 (4) $\dfrac{-477}{4}$ (5) $\dfrac{3}{4}$ (6) 18 (7) $\dfrac{-24786}{125}$ (8) $\dfrac{151}{32}$

(9) $\dfrac{-2}{27}$ (10) $\dfrac{-1}{8}$ (11) 1920 (12) $\dfrac{-14}{3}$ (13) 276 (14) $\dfrac{5}{81}$ (15) $\dfrac{-51}{1024}$ (16) $\dfrac{-22}{81}$

(17) $\dfrac{-3230}{27}$ (18) $\dfrac{5}{12}$ (19) $\dfrac{-2}{27}$ (20) $\dfrac{29}{2}$

(21) $(12+8x)e^{2x}$ (22) $\dfrac{-1}{x^2}$ (23) $\dfrac{6-2x}{e^x}$ (24) $\dfrac{11-6\ln(x)}{3x^4}$ (25) $\left(x^2+6x+10\right)e^x$

(26) $\dfrac{2x^2+2}{x^3}$ (27) $\dfrac{13-12\ln(x)}{x^5}$ (28) $\dfrac{-3e^{2x}+9e^x}{\left(e^x+3\right)^3}$ (29) $\dfrac{e^{\sqrt{x}+1}(\sqrt{x}-1)}{4x\sqrt{x}}$ (30) $\dfrac{-3x^4+18x}{2\left(x^3+3\right)^2}$

(31) $\dfrac{45}{8}x^{\frac{-7}{2}}-4^2e^{4x}$ (32) $\dfrac{1}{\left(x^2+1\right)^{\frac{3}{2}}}$ (33) $\dfrac{375}{8\left(x^2+1\right)^{\frac{3}{2}}}$ (34) $18x+2+2x^{-3}-6e^{3x}-9xe^{3x}$

(35) $81\cos(9-3x)$ (36) $\dfrac{1}{27}\sin\left(\dfrac{x}{3}\right)$ (37) $-9\sec^2(3x)$ (38) $-3\csc^2(x)$ (39) $\left[-4\cos(2x)+4\sin^2(2x)\right]e^{\cos(2x)-1}$

(40) $12\cos(2x)-12x\sin(2x)$ (41) $\dfrac{-4\sin(2\ln(x))-2\cos(2\ln(x))}{x^2}$ (42) $-12\sin(3x)-(18x-9)\cos(3x)$

(43) $\dfrac{-\sin^2(x)-4\sin(x)-2\cos^2(x)}{(\sin(x)+4)^3}$ (44) $-25\csc^2(5x)$ (45) -8 (46) $\dfrac{-1}{8}\cos\left(\dfrac{x}{2}\right)$

(47) $(6\cdot5\cdot4\cdot3)x^2+5^4e^{5x}$ (48) $2^{37}e^{2x}+23\cdot37!$ or $2^{37}e^{2x}+23(37\cdot36\cdot35\cdots3\cdot2\cdot1)$

(49) $\dfrac{-47!}{x^{48}}-3^{47}e^{-3x}$ or $\dfrac{-(47\cdot46\cdot45\cdots3\cdot2\cdot1)!}{x^{48}}-3^{47}e^{-3x}$

(50) $4^{45}e^{4x-5}+\dfrac{45!}{(x+2)^{46}}$ or $4^{45}e^{4x-5}+\dfrac{(45\cdot44\cdot43\cdots3\cdot2\cdot1)}{(x+2)^{46}}$ (51) e^{6-x}

(52) $(x+31)e^x-29!$ or $(x+31)e^x-(29\cdot28\cdot27\cdots3\cdot2\cdot1)$

(53) $(4x+336)e^{x+4}+\dfrac{4\cdot84!}{x^{85}}$ or $(4x+336)e^{x+4}+\dfrac{4\cdot(84\cdot83\cdot82\cdots3\cdot2\cdot1)}{x^{85}}$ (54) $\cos(x)$

(55) $-2^{54}\cos(2x-5)$ (56) $-3^{75}\cos(3x+1)$ (57) $(-2)^{124}\cos(3-2x)$ (58) $(-6)^{45}\sin(1-6x)$

(59) $-51\sin(x)-x\cos(x)$ (60) $10!$ or $(10\cdot9\cdot8\cdots3\cdot2\cdot1)$ (61) 0 (62) $\dfrac{53!}{x^{54}}$ or $\dfrac{(53\cdot52\cdot51\cdots3\cdot2\cdot1)}{x^{54}}$

(63) $-5^{101}e^{-5x}$ (64) $-2^5\ln^5(7)7^{5-2x}-\frac{1}{2^5}\sin(\frac{-x}{2})$ (65) $-3e^{-x}+3^{1007}\cos(3x)$