Chain Rule Practice

Date:

Differentiate each of the following. Where possible simplify your answers. Use the appropriate notation. Express answers using positive exponents only.

1. a) $y=(3x+5)^{\frac{2}{3}}$ b) $y=\sqrt{2-3x^2}$ c) $y=\sqrt{\dfrac{2x-5}{3x+1}}$

   d) $y=\left(\sqrt{x^2+3}\right)\left(\sqrt[3]{x^3-1}\right)$ e) $y=\sqrt[3]{2x^3-5x^2+x}$ f) $y=\dfrac{4x+6}{\sqrt{x^2+3x+4}}$

   g) $y=(4t^3-2t)^{-5}$ h) $y=\dfrac{\sqrt{x^2-1}}{x}$ i) $r=(s^4+3s^2+1)^{-\frac{2}{3}}$

   j) $y=\sqrt{9+\sqrt{9-x}}$ k) $y=(3x+2)^4(x^2-1)^{\frac{2}{3}}$ l) $h=\sqrt[3]{\dfrac{5x+6}{5x-4}}$

   m) $y=\dfrac{\sqrt[3]{x-1}}{\sqrt{x+1}}$ n) $v=\left(\dfrac{r+1}{r^2+1}\right)^3\left(r^3+4\right)^{\frac{1}{3}}$

2. a) $y=\sqrt{(x^3+4)^7-5}$ b) $y=\left(\left(x^2+3\right)^5+2\left(x^2+3\right)^{13}\right)^{10}$ c) $y=\sqrt{3-\sqrt{x^4+x^3}}$

Answers:

1. a) $\dfrac{dy}{dx}=\dfrac{2}{\sqrt[3]{3x+5}}$ b) $\dfrac{dy}{dx}=\dfrac{-3x}{\sqrt{2-3x^2}}$ c) $\dfrac{dy}{dx}=\dfrac{17}{2\sqrt{2x-5}(3x+1)^{\frac{3}{2}}}$

   d) $\dfrac{dy}{dx}=\dfrac{x\left(2x^3+3x-1\right)}{\left(x^3-1\right)^{\frac{2}{3}}\sqrt{x^2+3}}$ e) $\dfrac{dy}{dx}=\dfrac{6x^2-10x+1}{3\left(2x^3-5x^2+x\right)^{\frac{2}{3}}}$ f) $\dfrac{dy}{dx}=\dfrac{7}{\left(x^2+3x+4\right)^{\frac{3}{2}}}$

   g) $\dfrac{dy}{dt}=\dfrac{10(1-6t^2)}{\left(4t^3-2t\right)^6}$ h) $\dfrac{dy}{dx}=\dfrac{1}{x^2\sqrt{x^2-1}}$ i) $\dfrac{dr}{ds}=\dfrac{-4s(2s^2+3)}{3\left(s^4+3s^2+1\right)^{\frac{5}{3}}}$

   j) $\dfrac{dy}{dx}=\dfrac{-1}{4\sqrt{9+\sqrt{9-x}}\sqrt{9-x}}$ k) $\dfrac{dy}{dx}=\dfrac{4\left(12x^2+2x-9\right)(3x+2)^3}{3\sqrt[3]{x^2-1}}$

   l) $\dfrac{dh}{dx}=\dfrac{-50}{3(5x+6)^{\frac{2}{3}}(5x-4)^{\frac{4}{3}}}$ m) $\dfrac{dy}{dx}=\dfrac{5-x}{6(x-1)^{\frac{2}{3}}(x+1)^{\frac{3}{2}}}$

   n) $\dfrac{dv}{dr}=\dfrac{-(r+1)^2\left(2r^5+5r^4-4r^3+11r^2+24r-12\right)}{\left(r^2+1\right)^4\left(r^3+4\right)^{\frac{2}{3}}}$

2. a) $\dfrac{dy}{dx}=\dfrac{21x^2(x^3+4)^6}{2\sqrt{(x^3+4)^7-5}}$ b) $\dfrac{dy}{dx}=20x(x^2+3)^{49}\left(1+2(x^2+3)^8\right)^9\left(5+26(x^2+3)^8\right)$

   c) $\dfrac{dy}{dx}=\dfrac{-\sqrt{x}(4x+3)}{4\sqrt{x+1}\sqrt{3-\sqrt{x^4+x^3}}}$