Limit problems (§§2.6)

Do **one** step in evaluating each of the following derivatives. The first few have been done for you to illustrate. Solutions are on the second page for *checking* your answers. In the instances with strange functions, you might not know enough to calculate the derivative, but you *do* know enough to do the first step (which is what you are asked for here).

$$\left(\sin(x^5-1)\right)' = \cos(x^5-1)\cdot\left(x^5-1\right)'$$

$$\left((\sin(2x+1))^{-5}\right)' = -5(\sin(2x+1))^{-6}\cdot(\sin(2x+1))'$$

$$\left(\sin(t^2)+\cos(t^2)\right)' = (\sin(t^2))' + (\cos(t^2))'$$

$$\left(\sqrt{\Gamma(z)}\right)' = \frac{1}{2\sqrt{\Gamma(z)}}\cdot\Gamma'(z) \qquad \left(\text{Recall that } (\sqrt{x})' = \frac{1}{2\sqrt{x}}.\right)$$

$$\left(\sec(3x^2)\right)' =$$

$$\left(\sin(\sqrt{x})\cos(x+1)\right)' =$$

$$\left(\frac{\sin\pi x}{\pi x}\right)' =$$

$$(\cos(\text{anything}))' =$$

$$\left((\zeta(z)-1)^3\right)' =$$

$$\left(\sqrt{1-(\tfrac{v}{c})^2}\right)' =$$

$$\left(\frac{e^x-e^{-x}}{2}\right)' =$$

$$\left(t\int_a^t x^2\,dx\right)' =$$

$$\tfrac{d}{dx}\left(x^3\right) =$$

$$\tfrac{d}{dt}\left(x^3\right) =$$

$$\tfrac{d}{dx}\left(y^3\right) =$$

$$\left(i^{-\alpha}J_\alpha(ix)\right)' =$$

$$\left(\tan^{-1}x-\sin^{-1}x\right)' =$$

$$\left(f'(x^2)\right)' =$$

$$\big(\sin(x^5-1)\big)' = \cos(x^5-1)\cdot\big(x^5-1\big)'$$
$$\big((\sin(2x+1))^{-5}\big)' = -5(\sin(2x+1))^{-6}\cdot(\sin(2x+1))'$$
$$\big(\sin(t^2)+\cos(t^2)\big)' = (\sin(t^2))' + (\cos(t^2))'$$
$$\left(\sqrt{\Gamma(z)}\right)' = \frac{1}{2\sqrt{\Gamma(z)}}\cdot\Gamma'(z) \qquad \left(\text{Recall that } (\sqrt{x})' = \frac{1}{2\sqrt{x}}.\right)$$

$$\big(\sec(3x^2)\big)' = \sec(3x^2)\tan(3x^2)(3x^2)'$$

$$\big(\sin(\sqrt{x})\cos(x+1)\big)' = \sin(\sqrt{x})(\cos(x+1))' + (\sin(\sqrt{x}))'\cos(x+1)$$
$$\left(\frac{\sin\pi x}{\pi x}\right)' = \frac{\pi x(\sin\pi x)' - \sin(\pi x)(\pi x)'}{(\pi x)^2}$$

$$(\cos(\text{anything}))' = -\sin(\text{anything})\cdot(\text{anything})'$$

$$\big((\zeta(z)-1)^3\big)' = 3(\zeta(z)-1)^2\cdot(\zeta(z)-1)'$$

$$\left(\sqrt{1-(\tfrac{v}{c})^2}\,\right)' = \frac{1}{2\sqrt{1-(\tfrac{v}{c})^2}}(1-(\tfrac{v}{c})^2)'$$

$$\left(\frac{e^x-e^{-x}}{2}\right)' = \frac{1}{2}(e^x-e^{-x})' \qquad \left(\text{or } \left(\frac{e^x}{2}\right)' - \left(\frac{e^{-x}}{2}\right)'\right)$$

$$\left(t\int_a^t x^2\,dx\right)' = t\left(\int_a^t x^2\,dx\right)' + (t)'\int_a^t x^2\,dx$$

$$\tfrac{d}{dx}\left(x^3\right) = 3x^2$$

$$\tfrac{d}{dt}\left(x^3\right) = 3x^2\cdot\frac{dx}{dt}$$

$$\tfrac{d}{dx}\left(y^3\right) = 3y^2\cdot\frac{dy}{dx}$$

$$\big(i^{-\alpha}J_\alpha(ix)\big)' = i^{-\alpha}(J_\alpha(ix))' + (i^{-\alpha})'J_\alpha(ix)$$

$$\big(\tan^{-1}x - \sin^{-1}x\big)' = (\tan^{-1}x)' - (\sin^{-1}x)'$$

$$\big(f'(x^2)\big)' = f''(x^2)\cdot(x^2)'$$