9.2) Differentiating exponentials and logarithms

Worked example	Your turn
Prove that the derivative of a^{kx} is $a^{kx}k\ln a$	Prove that the derivative of a^{x} is $a^{x}\ln a$ Proof

Worked example	Your turn
Find: $$\frac{d}{dx}(5e^{2x})$$ $$\frac{d}{dx}(4e^{\frac{1}{3}x})$$ $$\frac{d}{dx}(3e^{-0.5x})$$	Find: $$\frac{d}{dx}(2e^{\frac{1}{4}x})$$ $$\frac{1}{2}e^{\frac{1}{4}x}$$

Worked example	Your turn
Find: $$\frac{d}{dx}(2^x)$$ $$\frac{d}{dx}(3^x)$$ $$\frac{d}{dx}(4^x)$$	Find: $$\frac{d}{dx}(5^x)$$ $$5^x \ln 5$$

Worked example	Your turn
Find: $$\frac{d}{dx}(5(2^x))$$ $$\frac{d}{dx}(4(3^x))$$ $$\frac{d}{dx}(3(4^x))$$	Find: $$\frac{d}{dx}(2(5^x))$$ $$5^x\ 2\ln 5$$

Worked example	Your turn
Find: $$\frac{d}{dx}(2^{5x})$$ $$\frac{d}{dx}(3^{4x})$$ $$\frac{d}{dx}(4^{3x})$$	Find: $$\frac{d}{dx}(5^{2x})$$ $$5^{2x}\,2\ln 5$$

Worked example	Your turn
Find:	Find:
$$\frac{d}{dx}(3^x)$$	$$\frac{d}{dx}(5^x)$$
	$5^x \ln 5$
$$\frac{d}{dx}(x^3)$$	$$\frac{d}{dx}(x^5)$$
	$5x^4$

Worked example	Your turn
Find:	Find:
$$\frac{d}{dx}(\ln 2x)$$	$$\frac{d}{dx}(\ln 5x)$$
	$$\frac{1}{x}$$
$$\frac{d}{dx}(\ln 3x)$$	
$$\frac{d}{dx}(\ln 4x)$$	

Worked example	Your turn
Find: $$\frac{d}{dx}(2\ln x)$$ $$\frac{d}{dx}(3\ln x)$$ $$\frac{d}{dx}(4\ln x)$$	Find: $$\frac{d}{dx}(5\ln x)$$ $$\frac{5}{x}$$

Worked example	Your turn
Find: $$\frac{d}{dx}(\ln x^2)$$ $$\frac{d}{dx}(\ln x^3)$$ $$\frac{d}{dx}(\ln x^4)$$	Find: $$\frac{d}{dx}(\ln x^5)$$ $$\frac{5}{x}$$

Worked example	Your turn
Find: $$\frac{d}{dx}\left(\frac{3+2e^{5x}}{7e^{4x}}\right)$$ $$\frac{d}{dx}\left(\frac{7-5e^{-4x}}{3e^{2x}}\right)$$	Find: $$\frac{d}{dx}\left(\frac{2-3e^{7x}}{4e^{3x}}\right)$$ $$-\frac{3}{2}e^{-3x}-3e^{4x}$$

Worked example	Your turn
Find: $$\frac{d}{dx}(e^x - 3)^2$$	Find: $$\frac{d}{dx}(e^x + 5)^2$$ $$2e^{2x} + 10e^x$$

Worked example	Your turn
The population P of a species after t days can be modelled using $P = 640(2^{-3t})$ a) Determine how many days have elapsed before there are 20 individuals left b) Determine the rate of change of the population after 3 days.	The population P of a species after t days can be modelled using $P = 460(3^{-2t})$ a) Determine how many days have elapsed before there are 20 individuals left b) Determine the rate of change of the population after 3 days. a) 1.43 days b) -1.39 individuals/day

Worked example	Your turn
A curve has the equation $$y = e^{4x} - \ln x$$ Show that the equation of the tangent to the curve at the point with x-coordinate 1 is: $$y = (4e^4 - 1)x - 3e^4 + 1$$	A curve has the equation $$y = e^{3x} - \ln x$$ Show that the equation of the tangent to the curve at the point with x-coordinate 1 is: $$y = (3e^3 - 1)x - 2e^3 + 1$$ Shown

Worked example	Your turn
A curve has the equation $$y = 5(2^{3x})$$ Find the equation of the normal to the curve at the point with x-coordinate 1 in the form $y = ax + b$, where a and b are constants to be found in exact form	A curve has the equation $$y = 4(3^{2x})$$ Find the equation of the normal to the curve at the point with x-coordinate 1 in the form $y = ax + b$, where a and b are constants to be found in exact form

$$y = -\frac{1}{72\ln 3}x + \frac{1}{72\ln 3} + 36$$

$$a = -\frac{1}{72\ln 3}$$

$$b = \frac{1}{72\ln 3} + 36$$