$\boxed{\text{WORKSHEET 17}}$

$\boxed{1.}$ $g(x) = \log(2x^5 + \sin(x))$

note that $\log = \log_{10}$ so by the base change formula

$$g(x) = \frac{1}{\ln(10)} \cdot \ln(2x^5 + \sin(x))$$

So $$g'(x) = \frac{1}{\ln(10)} \cdot \frac{1}{2x^5 + \sin(x)} \cdot [10x^4 + \cos(x)]$$

$$= \boxed{\frac{10x^4 + \cos(x)}{\ln(10)[2x^5 + \sin(x)]}}$$

$\boxed{2.}$ $h(x) = x^3 \cdot \ln(6x) + 4x \cdot e^{5x^3 - 2x}$

$$h'(x) = \left[3x^2 \cdot \ln(6x) + x^3 \cdot \frac{1}{6x} \cdot 6\right] +$$

$$+ \left[4 \cdot 1 \cdot e^{5x^3 - 2x} + 4x\, e^{5x^3 - 2x} \cdot (15x^2 - 2)\right]$$

$$h'(x) = 3x^2 \ln(6x) + x^2 + 4e^{5x^3-2x}\left[1 + 15x^3 - 2x\right]$$

3\. $y = x^{2x}$

Take "ln" of both sides

$$\ln y = \ln\left(x^{2x}\right) = 2x \cdot \ln x$$

Now take $\frac{d}{dx}$ of both sides:

$$\frac{d}{dx}\left(\ln(y)\right) = \frac{d}{dx}\left(2x \ln x\right)$$

chain rule

$$\frac{1}{y} \cdot \frac{dy}{dx} = 2 \ln x + 2x \cdot \left(\frac{1}{x}\right)$$

$$\frac{dy}{dx} = y\left(2 \ln(x) + 2\right) =$$

$$\boxed{= 2x^{2x}\left(\ln(x) + 1\right)}$$

$\boxed{1}$ Find eq. of tg line at $x=3$

$$G(x) = \log(\sqrt{x}) = \frac{1}{2}\log(x)$$

$$G(3) = 0.23856$$

$$G(x) = \frac{1}{2}\log(x) = \frac{1}{2}\frac{1}{\ln(10)} \cdot \ln x$$

$$G'(x) = \frac{1}{2\ln(10)} \cdot \frac{1}{x}$$

$$G'(3) = \frac{1}{2\ln(10)} \cdot \frac{1}{3} = 0.07238$$

So:

$$y - 0.23856 = 0.07238(x-3)$$

$$\boxed{y = 0.07238 \cdot x + 0.02141276}$$

$\boxed{2}$ $$H(x) = e^{-x^2} \cdot \ln(7x)$$

$$H(3) = e^{-9} \cdot \ln(21) = 0.000375724$$

$$H'(x) = e^{-x^2}(-2x) \cdot \ln(7x) + e^{-x^2} \cdot \frac{1}{7x} \cdot 7$$

$$= e^{-x^2}\left[-2x\ln(7x) + \frac{1}{x}\right]$$

$$H'(3) = e^{-9}\left(-6\ln(21) + \frac{1}{3}\right)$$

$$= -0.0022132$$

So the equation of the tg line is

$$y - 0.000375724 = -0.0022132\,(x-3)$$

$$\boxed{y = -0.0022132\,x + 0.007015345}$$