Initials: ________ **2.4 Day 5 – Level 1**

Find the derivative of $f(x)=\frac{x}{\sqrt{2x-1}}$. $= \frac{x}{(2x-1)^{1/2}}$ $= x(2x-1)^{-1/2}$

$f'(x) = \frac{(1)(2x-1)^{1/2} - x\left(\frac{1}{2}(2x-1)^{-\frac{1}{2}}\cdot 2\right)}{\left((2x-1)^{1/2}\right)^2}$

$= \frac{(2x-1)^{1/2} - x(2x-1)^{-1/2}}{2x-1}$ GCF: $(2x-1)^{-\frac{1}{2}}$

$= \frac{(2x-1)^{-\frac{1}{2}}(2x-1-x)}{(2x-1)^1}$

$= \boxed{\frac{x-1}{(2x-1)^{3/2}}}$

OR

$f'(x) = (1)(2x-1)^{-1/2} + x\left(-\frac{1}{2}(2x-1)^{-3/2}\cdot 2\right)$

$= (2x-1)^{-1/2} - x(2x-1)^{-3/2}$

GCF: $(2x-1)^{-3/2}$

$= (2x-1)^{-3/2}(2x-1-x)$

$= \boxed{\frac{x-1}{(2x-1)^{3/2}}}$

Initials: ________ **2.4 Day 5 – Level 2**

Find the derivative of $g(x)=\left(\frac{1-2x}{1+x}\right)^3$.

$-2-2x-1+2x$

$g'(x) = 3\left(\frac{1-2x}{1+x}\right)^2 \cdot \frac{-2(1+x)-(1)(1-2x)}{(1+x)^2}$

$= \frac{3(1-2x)^2}{(1+x)^2}\cdot\frac{-3}{(1+x)^2}$

$= \boxed{\frac{-9(1-2x)^2}{(1+x)^4}}$

Initials: ________ **2.4 Day 5 – Level 3**

Write the equation of the tangent line to $y = \cos^2(3x)$ at the point where $x = \frac{\pi}{12}$.

$y = (\cos(3x))^2$

$y' = 2\cos(3x) \cdot -\sin(3x) \cdot 3$

$y' = -6\cos(3x)\sin(3x)$

$y'\left(\frac{\pi}{12}\right) = -6\cos\left(\frac{3\cdot\pi}{12}\right)\sin\left(\frac{3\pi}{12}\right)$

$= -6\cos\left(\frac{\pi}{4}\right)\sin\left(\frac{\pi}{4}\right)$

$= -6 \cdot \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{2}}{2}$

$= -6\left(\frac{1}{2}\right) = -3$

$y\left(\frac{\pi}{12}\right) = \cos^2\left(\frac{3\pi}{12}\right) =$

$= \left(\cos\left(\frac{\pi}{4}\right)\right)^2$

$= \left(\frac{\sqrt{2}}{2}\right)^2 = \frac{1}{2}$

$\left(\frac{\pi}{12}, \frac{1}{2}\right)$, $m = -3$

$$\boxed{y - \frac{1}{2} = -3\left(x - \frac{\pi}{12}\right)}$$

Initials: ________ **2.4 Day 5 – Level 4**

Write the equation of the tangent line to $f(x) = \sqrt{x}(2-x)^2$ at the point (4, 8).

$f(x) = x^{1/2} \cdot (2-x)^2$

$f'(x) = \frac{1}{2}x^{-\frac{1}{2}}(2-x)^2 + x^{\frac{1}{2}} \cdot 2(2-x) \cdot -1$

OR

$= \frac{1}{2}x^{-\frac{1}{2}}(2-x)^2 - 2x^{1/2}(2-x)$

GCF: $x^{-1/2}(2-x)$

$= x^{-\frac{1}{2}}(2-x)\left(\frac{1}{2}(2-x) - \frac{2x}{1}\cdot\frac{2}{2}\right)$

$= \frac{2-x}{x^{1/2}} \cdot \frac{2-x-4x}{2}$

$$= \boxed{\frac{(2-x)(2-5x)}{2\sqrt{x}}}$$

$= \frac{(2-x)^2}{2\sqrt{x}} - \frac{2\sqrt{x}(2-x)\cdot 2\sqrt{x}}{1 \cdot 2\sqrt{x}}$

$= \frac{(2-x)^2 - 4x(2-x)}{2\sqrt{x}}$

GCF: $(2-x)$

$= \frac{(2-x)(2-x-4x)}{2\sqrt{x}}$

$$= \boxed{\frac{(2-x)(2-5x)}{2\sqrt{x}}}$$

Initials: _________ **2.4 Day 5 – Level 5**

Find the second derivative of $f(x) = \sin x^2$. Then evaluate $f''(x)$ at (0,1).

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

$= 2x \cdot \cos(x^2)$

$f''(x) = 2\cos(x^2) + 2x \cdot -\sin(x^2) \cdot 2x$

$= 2\cos(x^2) - 4x^2 \sin(x^2)$

$f''(0) = 2\cos(0) - 4(0)^2 \sin(0)$

$= \boxed{2}$

Initials: _________ **2.4 Day 5 – Level 6**

a) At what point(s) does the function $y = \sqrt[3]{(x^2-1)^2}$ have a horizontal tangent line?

$y = (x^2-1)^{2/3}$

$y' = \frac{2}{3}(x^2-1)^{-1/3} \cdot 2x$

$y' = \dfrac{4x}{3(x^2-1)^{1/3}} = 0$

$m = 0$

$4x = 0$

$x = 0$

$y = (-1)^{2/3} = 1$

$\boxed{(0,1)}$

b) At what point(s) is the derivative undefined? m undef.

for $y' = \dfrac{4x}{3(x^2-1)^{1/3}}$ to be undefined, $3(x^2-1)^{1/3} = 0$

$x^2 - 1 = 0$

$x = \pm 1 = 0$

$y = ((\pm 1)^2 - 1)^{2/3} = 0$

$\boxed{(1,0), (-1,0)}$