

1. C: $y = x^2$; P(2,4)

a) $\lim_{x \rightarrow 2} \frac{x^2 - 2^2}{x - 2} = \lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2} = \lim_{x \rightarrow 2} \frac{(x+2)(x-2)}{x-2} = \boxed{4}$

b) $y - 4 = 4(x-2)$
 $y - 4 = 4x - 8$
 $+4 \quad +4$
 $\hline y = 4x - 4$

2. C: $y = \frac{1}{x}$; P(1,1)

a) $\lim_{x \rightarrow 1} \frac{\frac{1}{x} - 1}{x - 1} = \lim_{x \rightarrow 1} \frac{\frac{1}{x} - \frac{x}{x}}{x - 1} = \lim_{x \rightarrow 1} \frac{\frac{1-x}{x}}{x-1} = \lim_{x \rightarrow 1} \frac{1-x}{x} \cdot \frac{1}{x-1} =$
 $\lim_{x \rightarrow 1} \frac{-(x-1)}{x} \cdot \frac{1}{(x-1)} = \boxed{-1}$

b) $y - 1 = -1(x-1)$
 $y - 1 = -x + 1$
 $+1 \quad +1$
 $\hline y = -x + 2$



3. C: $y = 2x - x^2$; P(1,1)

a) $\lim_{x \rightarrow 1} \frac{2x - x^2 - (1)}{x - 1} = \lim_{x \rightarrow 1} \frac{-(x^2 - 2x + 1)}{x - 1} = \lim_{x \rightarrow 1} \frac{-(x-1)(x-1)}{(x-1)} = \boxed{0}$

b) $y = 1$

4. C: $y = x^2 + x$; P(-1,0)

a) $\lim_{x \rightarrow -1} \frac{x^2 + x - 0}{x + 1} = \lim_{x \rightarrow -1} \frac{x(x+1)}{(x+1)} = \boxed{-1}$

b) $y - 0 = -1(x+1)$
 $\hline y = -x - 1$

5. c: $y = \frac{1}{1-x}$; P(2, -1)

a) $\lim_{x \rightarrow 2} \frac{\frac{1}{1-x} - \frac{1}{1-(-1)}}{x-2} = \lim_{x \rightarrow 2} \frac{\frac{1}{1-x} + \frac{1-x}{1-x}}{x-2} = \lim_{x \rightarrow 2} \frac{1+1-x}{1-x} \cdot \frac{1}{x-2} =$

$$\lim_{x \rightarrow 2} \frac{(2-x)}{(1-x)(x-2)} = \lim_{x \rightarrow 2} \frac{-(x-2)}{(1-x)(x-2)} = \frac{-1}{1-2} = \boxed{1}$$

b) $y+1 = 1(x-2)$

$$\boxed{y = x-3}$$

6. c: $y = x^3 + 1$; P(2, 9)

a) $\lim_{x \rightarrow 2} \frac{x^3+1-9}{x-2} = \lim_{x \rightarrow 2} \frac{x^3-8}{x-2} = \lim_{x \rightarrow 2} \frac{(x-2)(x^2+2x+4)}{(x-2)} = \boxed{12}$

b) $y-9 = 12(x-2)$

$$\begin{array}{r} y-9 = 12x-24 \\ +9 \quad +9 \\ \hline y = 12x-15 \end{array}$$

7. c: $y = 1-x^3$; P(-1, 2)

a) $\lim_{x \rightarrow -1} \frac{1-x^3-2}{x+1} = \lim_{x \rightarrow -1} \frac{-1-x^3}{x+1} = \lim_{x \rightarrow -1} \frac{-(x^3+1)}{(x+1)} = \lim_{x \rightarrow -1} \frac{-(x+1)(x^2-x+1)}{(x+1)} = \boxed{-3}$

b) $y-2 = -3(x+1)$

$$\begin{array}{r} y-2 = -3x-3 \\ +2 \quad +2 \\ \hline y = -3x-1 \end{array}$$

8. c: $y = \frac{6}{x+1}$; P(1, 3)

a) $\lim_{x \rightarrow 1} \frac{\frac{6}{x+1}-3}{x-1} = \lim_{x \rightarrow 1} \frac{\frac{6}{x+1}-\frac{3(x+1)}{x+1}}{x-1} = \lim_{x \rightarrow 1} \frac{3-3x}{x+1} \cdot \frac{1}{x-1} = \lim_{x \rightarrow 1} \frac{-3(x-1)}{(x+1)(x-1)} = \boxed{-\frac{3}{2}}$

b) $y-3 = -\frac{3}{2}(x-1)$

$$\boxed{y = -\frac{3}{2}x + \frac{9}{2}}$$

$$9. f(x) = x^4$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{(x+h)^4 - x^4}{h}$$

$$= \lim_{h \rightarrow 0} \frac{x^4 + 4x^3h + 6x^2h^2 + 4xh^3 + h^4 - x^4}{h}$$

$$= \lim_{h \rightarrow 0} \cancel{4x^3} + \cancel{6x^2h} + \cancel{4xh^2} + \cancel{h^3}$$

$$\boxed{4x^3}$$

$$(x+h)^4$$

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$$(x^2 + 2xh + h^2)(x^2 + 2xh + h^2)$$

$$x^4 + 2x^3h + x^2h^2$$

$$2x^3h + 4x^2h^2 + 2xh^3$$

$$x^2h^2 + 2xh^3 + h^4$$

$$x^4 + 4x^3h + 6x^2h^2 + 4xh^3 + h^4$$

$$10. f(x) = \frac{1}{x^3}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\frac{1}{(x+h)^3} - \frac{1}{x^3}}{h} = \lim_{h \rightarrow 0} \frac{\frac{x^3}{x^3(x+h)^3} - \frac{(x+h)^3}{x^3(x+h)^3}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{x^3 - x^3 - 3x^2h - 3xh^2 - h^3}{x^3(x+h)^3} \cdot \frac{1}{h}$$

$$= \lim_{h \rightarrow 0} \frac{-3x^2 - 3xh - h^2}{x^3(x+h)^3}$$

$$= \frac{-3x^2}{x^3 x^3} = \frac{-3x^2}{x^6} = \boxed{\frac{-3}{x^4}}$$

$$\begin{aligned} & (x+h)(x+h) \\ & (x^2 + 2xh + h^2)(x+h) \\ & x^3 + 2x^2h + xh^2 \\ & + x^2h + 2xh^2 + h^3 \\ & \hline x^3 + 3x^2h + 3xh^2 + h^3 \end{aligned}$$

$$\text{II. } f(x) = \frac{1}{\sqrt{x}}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\frac{1}{\sqrt{x+h}} - \frac{1}{\sqrt{x}}}{h} = \lim_{h \rightarrow 0} \frac{\frac{\sqrt{x}}{\sqrt{x}\sqrt{x+h}} - \frac{\sqrt{x+h}}{\sqrt{x}\sqrt{x+h}}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\sqrt{x} - \sqrt{x+h}}{\sqrt{x}\sqrt{x+h}} \cdot \frac{1}{h} = \lim_{h \rightarrow 0} \frac{\sqrt{x} - \sqrt{x+h}}{(\sqrt{x})(\sqrt{x+h})(h)} \cdot \frac{(\sqrt{x} + \sqrt{x+h})}{(\sqrt{x} + \sqrt{x+h})}$$

$$= \lim_{h \rightarrow 0} \frac{(x) - (x+h)}{(\sqrt{x})(\sqrt{x+h})(h)(\sqrt{x} + \sqrt{x+h})} = \lim_{h \rightarrow 0} \frac{x - x - h}{(\sqrt{x})(\sqrt{x+h})(h)(\sqrt{x} + \sqrt{x+h})}$$

$$= \lim_{h \rightarrow 0} \frac{-1}{\sqrt{x}\sqrt{x+h}(\sqrt{x} + \sqrt{x+h})} = \frac{-1}{\sqrt{x}\sqrt{x}(\sqrt{x} + \sqrt{x})}$$

$$\begin{aligned} &= \frac{-1}{x(2\sqrt{x})} \\ &= \frac{-1}{2x \cdot x^{\frac{1}{2}}} \\ &= \frac{-1}{2x^{\frac{3}{2}}} \end{aligned}$$

$$\text{? } f(x) = \sqrt{1-x}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\sqrt{1-(x+h)} - \sqrt{1-x}}{h} \cdot \frac{\sqrt{1-(x+h)} + \sqrt{1-x}}{\sqrt{1-(x+h)} + \sqrt{1-x}}$$

$$= \lim_{h \rightarrow 0} \frac{[1-(x+h)] - (1-x)}{h(\sqrt{1-(x+h)} + \sqrt{1-x})} = \lim_{h \rightarrow 0} \frac{1-x-h - 1+x}{(h)(\sqrt{1-(x+h)} + \sqrt{1-x})}$$

$$= \lim_{h \rightarrow 0} \frac{-1}{\cancel{\sqrt{1-(x+h)} + \sqrt{1-x}}} = \frac{-1}{\sqrt{1-x} + \sqrt{1-x}}$$

$$\begin{aligned} &= \frac{-1}{2\sqrt{1-x}} \\ &= -\frac{1}{2}(1-x)^{-\frac{1}{2}} \end{aligned}$$

$$13. f(x) = \frac{x}{x+1}$$

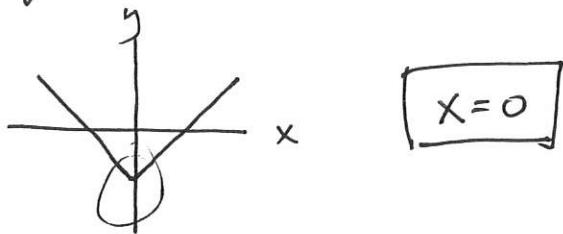
$$\begin{aligned}
 f'(x) &= \lim_{h \rightarrow 0} \frac{\frac{x+h}{x+h+1} - \frac{x}{x+1}}{h} = \lim_{h \rightarrow 0} \frac{(x+h)(x+1)}{(x+h+1)(x+1)} - \frac{x(x+h+1)}{(x+h+1)(x+1)} \\
 &= \lim_{h \rightarrow 0} \frac{x^2 + x + xh + h - x^2 - xh - x}{(x+h+1)(x+1)} \\
 &= \lim_{h \rightarrow 0} \frac{h}{(x+h+1)(x+1)} \cdot \frac{1}{h} = \frac{1}{(x+1)(x+1)} \\
 &= \boxed{\frac{1}{(x+1)^2}}
 \end{aligned}$$

$$14. f(x) = \frac{1}{x^2 + 1}$$

$$\begin{aligned}
 f'(x) &= \lim_{h \rightarrow 0} \frac{\frac{1}{(x+h)^2 + 1} - \frac{1}{x^2 + 1}}{h} = \lim_{h \rightarrow 0} \frac{\frac{x^2 + 1}{[(x+h)^2 + 1](x^2 + 1)}}{h} - \frac{\frac{(x+h)^2 + 1}{[(x+h)^2 + 1](x^2 + 1)}}{h} \\
 &= \lim_{h \rightarrow 0} \frac{x^2 + 1 - x^2 - 2xh - h^2 - 1}{[(x+h)^2 + 1](x^2 + 1)} \cdot \frac{1}{h} \\
 &= \lim_{h \rightarrow 0} \frac{-2x - h}{[(x+h)^2 + 1](x^2 + 1)} = \frac{-2x}{(x^2 + 1)(x^2 + 1)} \\
 &= \boxed{\frac{-2x}{(x^2 + 1)^2}}
 \end{aligned}$$

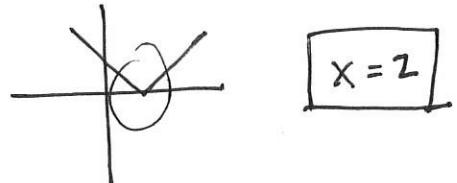
$$15. g(x) = |x| - 2$$

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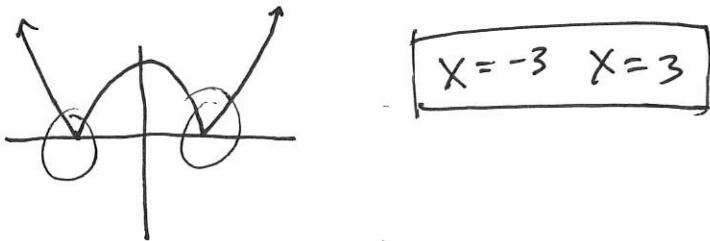
$$x = 0$$

$$16. g(x) = |x - 2|$$



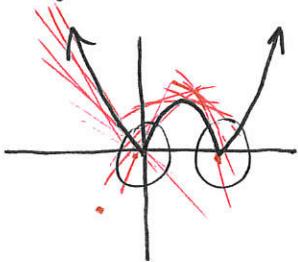
$$x = 2$$

$$17. g(x) = |9 - x^2|$$



$$x = -3 \quad x = 3$$

$$18. g(x) = |4x - x^2|$$



$$x = 0 \quad x = 4$$

$$1. P(x) = 2x^2 + 5x - 1$$

$$P'(x) = 4x + 5$$

← derivative
plug into derivative to find slope at the found point

$$\begin{aligned} P(-3) &= 2(-3)^2 + 5(-3) - 1 \\ &= 18 - 15 - 1 \\ &= 2 \end{aligned}$$

plug into function for point

$$2. P(x) = x^2 - 3x - 1$$

$$P'(x) = 2x - 3$$

$$\begin{aligned} P(2) &= 2^2 - 3(2) - 1 \\ &= 4 - 6 - 1 \\ &= -3 \end{aligned}$$

$$\begin{aligned} P'(2) &= 2(2) - 3 \\ &= 4 - 3 \\ M &= 1 \end{aligned}$$

$$\begin{aligned} y + 3 &= 1(x - 2) \\ -3 &\quad -3 \\ \hline y &= x - 5 \end{aligned}$$

$$y - 2 = -7(x + 3)$$

$$y - 2 = -7x - 21$$

$$\begin{array}{r} +2 \\ \hline y = -7x - 19 \end{array}$$

use point slope form to write tangent line equation.

$$3. P(x) = x^3 - 3x^2 + 8$$

$$P'(x) = 3x^2 - 6x$$

$$\begin{aligned} P'(2) &= 3(2)^2 - 6(2) \\ M &= 12 - 12 = 0 \end{aligned}$$

oops, I did this
First, sorry

$$\begin{aligned} P(2) &= (2)^3 - 3(2)^2 + 8 \\ &= 8 - 12 + 8 \\ &= 4 \\ (2, 4) \end{aligned}$$

$$\begin{aligned} y - 4 &= 0(x - 2) \\ +4 &\quad +4 \\ \hline y &= 4 \end{aligned}$$

$$4. P(x) = x^3 + x^2 + x + 2$$

$$\begin{aligned} P(-1) &= (-1)^3 + (-1)^2 + (-1) + 2 \\ &= -1 + 1 - 1 + 2 \\ &= 1 \end{aligned}$$

$$(-1, 1)$$

$$P'(x) = 3x^2 + 2x + 1$$

$$\begin{aligned} P'(-1) &= 3(-1)^2 + 2(-1) + 1 \\ &= 3 - 2 + 1 \\ M &= 2 \end{aligned}$$

~~M~~

year.

$$y - 1 = 2(x + 1)$$

$$y - 1 = 2x + 2$$

$$\begin{array}{r} +1 \quad +1 \\ \hline y = 2x + 3 \end{array}$$

Aw man, I am all sorts of
messing up. The math is all
good but my organization is
whack.

ugh

$$(5) P(x) = x^4 - x^2 + 2x + 1$$

$$\boxed{P'(x) = 4x^3 - 2x + 2}$$

$$P(1) = (1)^4 - (1)^2 + 2(1) + 1$$

$$= 1 - 1 + 2 + 1$$

$$= 3$$

$$(1, 3)$$

$$P'(x) = 4(1)^3 - 2(1) + 2$$

$$= 4 - 2 + 2$$

$$\stackrel{M}{=} 4$$

$$y - 3 = 4(x - 1)$$

$$y - 3 = 4x - 4$$

$$\frac{+3}{\hline y = 4x - 1}$$

$$(6) P(x) = x^4 - 4x^3 + 20$$

$$\boxed{P'(x) = 4x^3 - 12x^2}$$

That looks like a box!

$$P(3) = (3)^4 - 4(3)^3 + 20$$

$$= 81 - 108 + 20$$

$$= -27 + 20$$

$$= -7$$

$$(3, -7)$$

$$P'(3) = 4(3)^3 - 12(3)^2$$

$$= 108 - 108$$

$$\stackrel{M}{=} 0$$

$$y + 7 = 0(x - 3)$$

$$\frac{-7}{\hline y = -7}$$

$$⑦ f(x) = (x-1)\sqrt{x}$$

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

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

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

common denominator

$$= \frac{x-1+2x}{2\sqrt{x}}$$

$$= \boxed{\frac{3x-1}{2\sqrt{x}}}$$

$$⑧ G(x) = (1-x^2)\sqrt{x}$$

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

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

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

$$= \frac{1-5x^2}{2\sqrt{x}} = \boxed{\frac{1-5x^2}{2\sqrt{x}}}$$

$$⑩ f(x) = \frac{1}{2x+1} = (2x+1)^{-1}$$

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

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

Actually 10 and 11 you might need to use the quotient rule. Unless we cover the chain rule before you do this assignment

$$⑨ \phi(x) = \frac{1}{x^2+1}$$

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

$$\phi'(x) = -1(x^2+1)^{-2}(2x)$$

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

$$⑪ g(x) = \sqrt{x}(x-1)^2$$

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

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

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

$$= \frac{4x^2-4x+x^2-2x+1}{2\sqrt{x}}$$

$$= \boxed{\frac{5x^2-6x+1}{2\sqrt{x}}}$$

$$(12) \quad \psi(x) = (3x)(\sqrt{x})$$

$$\begin{aligned}\psi'(x) &= (3x)\left(\frac{1}{2}x^{-\frac{1}{2}}\right) + x^{\frac{1}{2}}(3) \\ &= \frac{3x}{2\sqrt{x}} + \frac{3\sqrt{x}}{1}\left(\frac{2\sqrt{x}}{2\sqrt{x}}\right) \\ &= \frac{3x + 6x}{2\sqrt{x}} \quad \boxed{\frac{9x}{2\sqrt{x}}}\end{aligned}$$

$$(13) \quad g(x) = \frac{x^2}{1-x^2} \frac{u}{v}$$

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

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

$$(14) \quad \phi(x) = \frac{x^2 + 1}{x^2}$$

$$\begin{aligned}\phi'(x) &= \frac{x^2(2x) - (x^2+1)(2x)}{(x^2)^2} \\ &= \frac{2x^3 - 2x^3 - 2x}{x^4} = \frac{-2x}{x^4} \\ &= \boxed{-\frac{2}{x^3}}\end{aligned}$$

$$(15) \quad f(x) = \frac{1+\sqrt{x}}{1-\sqrt{x}}$$

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

$$= \frac{\frac{1-\sqrt{x}}{2\sqrt{x}} + \frac{1+\sqrt{x}}{2\sqrt{x}}}{(1-\sqrt{x})^2} = \frac{\cancel{2}}{\cancel{(1-\sqrt{x})^2}} \quad \boxed{\frac{2}{(1-\sqrt{x})^2}}$$

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

$$(16) \quad g(x) = \frac{\sqrt{x}}{1+\sqrt{x}}$$

$$g'(x) = \frac{(1+\sqrt{x})(\frac{1}{2}x^{-\frac{1}{2}}) - (x^{\frac{1}{2}})(\frac{1}{2}x^{-\frac{1}{2}})}{(1+\sqrt{x})^2}$$

$$= \frac{\frac{1+\sqrt{x}}{2\sqrt{x}} - \frac{\sqrt{x}}{2\sqrt{x}}}{(1+\sqrt{x})^2} = \frac{\frac{1+\sqrt{x}-\sqrt{x}}{2\sqrt{x}}}{(1+\sqrt{x})^2} = \frac{\frac{1}{2\sqrt{x}}}{(1+\sqrt{x})^2} \quad \boxed{\frac{1}{2\sqrt{x}(1+\sqrt{x})^2}}$$

pg. 236 1-11 odds

2-12 evens
is on the
next page
sorry

$$\textcircled{1} \quad (2x-x^2)^5$$

$$5(2x-x^2)^4(2-2x)$$

$$\boxed{10(2x-x^2)^4(1-x)}$$

$$(10-10x)(2x-x^2)^4$$

$$u = 2x-x^2$$

$$du = 2-2x$$

$$\frac{d}{dx}[u \pm v] = u' \pm v'$$

$$\textcircled{3} \quad \sqrt{2x+3} = (2x+3)^{\frac{1}{2}}$$

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

$$\boxed{\frac{1}{\sqrt{2x+3}}}$$

$$\textcircled{5} \quad \sqrt{4-x^2} = (4-x^2)^{\frac{1}{2}}$$

$$\frac{1}{2}(4-x^2)^{-\frac{1}{2}}(-2x)$$

$$\boxed{\frac{-x}{\sqrt{4-x^2}}}$$

$$\textcircled{7} \quad \frac{1}{\sqrt{x^2+1}} = (x^2+1)^{-\frac{1}{2}}$$

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

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

$$\textcircled{9} \quad \sqrt{\frac{x}{1-x}} = \left(\frac{x}{1-x}\right)^{\frac{1}{2}}$$

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

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

$1-x+x$

$$\textcircled{11} \quad x^2\sqrt{4-x} = x^2(4-x)^{\frac{1}{2}}$$

$$x^2\left(\frac{1}{2}(4-x)^{-\frac{1}{2}}(-1) + (4-x)^{\frac{1}{2}}(2x)\right)$$

$$\frac{-x^2}{2\sqrt{4-x}} + \frac{(4-x)^{\frac{1}{2}}(2x)(2)(4-x)^{\frac{1}{2}}}{2(4-x)^{\frac{1}{2}}}$$

$$\frac{-x^2+16x-4x^2}{2\sqrt{4-x}} = \boxed{\frac{-5x^2+16x}{2\sqrt{4-x}}}$$

$$\textcircled{2.} \quad (x^3 + 3x)^{10}$$

$$10(x^3 + 3x)^9(3x^2 + 3)$$

$$(30x^2 + 30)(x^3 + 3x)^9$$

$$\textcircled{4.} \quad \sqrt{1-x} = (1-x)^{\frac{1}{2}}$$

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

$$\boxed{\frac{-1}{2\sqrt{1-x}}}$$

$$\textcircled{b.} \quad \sqrt{x^2 - 9} = (x^2 - 9)^{\frac{1}{2}}$$

$$\frac{1}{2}(x^2 - 9)^{-\frac{1}{2}}(2x)$$

$$\boxed{\frac{x}{\sqrt{x^2 - 9}}}$$

$$\textcircled{8.} \quad (1-x^2)^{\frac{3}{2}}$$

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

$$\boxed{-3x\sqrt{1-x^2}}$$

$$\textcircled{10.} \quad \sqrt{\frac{x+2}{x-2}} = \left(\frac{x+2}{x-2}\right)^{\frac{1}{2}} x^{-2} - x^{-2}$$

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

$$\frac{1}{2}\left(\frac{(x+2)}{(x-2)^{\frac{1}{2}}}\right)\left(\frac{-4}{(x-2)^2}\right)$$

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

$$\textcircled{12.} \quad \frac{x}{\sqrt{2x-1}} = \frac{x}{(2x-1)^{\frac{1}{2}}}$$

$$\frac{(2x-1)^{\frac{1}{2}}(1) - x\left(\frac{1}{2}(2x-1)^{-\frac{1}{2}}(2)\right)}{\cancel{(2x-1)}\left[\cancel{(2x-1)^{\frac{1}{2}}}\right]^2}$$

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

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

$$\frac{\cancel{(2x-1)}(-x)(2x-1)^{-\frac{3}{2}} + \frac{1}{\sqrt{2x-1}}}{\cancel{\sqrt{2x-1}}} \\ \frac{-x(\sqrt{2x-1})(2x-1)^{-\frac{3}{2}} + 1}{\sqrt{2x-1}}$$

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

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

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

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

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

$$x\left(\frac{1}{2}\right)(2x-1)^{-\frac{3}{2}}(2) + (2x-1)^{-\frac{1}{2}}(\cancel{x})$$

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

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

$$(27) \quad y = \frac{(3x^2 - 9)^5}{(2x^2 + 1)^3}$$

$$\frac{(2x^2 + 1)^3 (5)(3x^2 - 9)^4 (6x) - (3x^2 - 9)^5 (3)(2x^2 + 1)^2 (4x)}{[(2x^2 + 1)^3]^2}$$

$$\frac{(2x^2 + 1)^2 \left[5(3x^2 - 9)^4 (6x) - (3x^2 - 9)^5 (3)(4x) \right]}{(2x^2 + 1)^4}$$

$$\frac{30x(3x^2 - 9)^4 - 12x(3x^2 - 9)^5}{(2x^2 + 1)^4}$$

$$\frac{6x(3x^2 - 9)^4 \left[5\cancel{(2x^2 + 1)} - 2(3x^2 - 9) \right]}{(2x^2 + 1)^4}$$

~~$6x^2 + 18$~~
 ~~$6x^2 + 23$~~

$$\boxed{6x(3x^2 - 9)^4 (4x^2 + 23)(2x^2 + 1)^{-4}}$$

$$4x + 8 \\ 4(x+2)$$

$$(28) \quad y = (4x^2 + 5)^3 (x+9)^2$$

$$(4x^2 + 5)^3 (2)(x+9)^1 + (x+9)^2 (3)(4x^2 + 5)^2 (8x)$$

$$2(4x^2 + 5)^2 (x+9) \left[(4x^2 + 5) + (x+9)(12x) \right]$$

$$4x^2 + 5 + 12x^2 + 108x \\ 16x^2 + 108x + 5$$

$$\boxed{2(4x^2 + 5)^2 (x+9)(16x^2 + 108x + 5)}$$

$$(29) \quad y = (5x^2 + 2x + 1)^{10} (3x^2 + 6)^4$$

$$y' = (5x^2 + 2x + 1)^{10} (4)(3x^2 + 6)^3 (6x) + (3x^2 + 6)^4 (10)(5x^2 + 2x + 1)^9 (10x + 2)$$

$$24x (5x^2 + 2x + 1)^{10} (3x^2 + 6)^3 + (20)(3x^2 + 6)^4 (5x^2 + 2x + 1)^9 (5x + 1)$$

$$4 (5x^2 + 2x + 1)^9 (3x^2 + 6)^3 \left[6x(5x^2 + 2x + 1) + 5 (3x^2 + 6) \right]$$

$$30x^3 + 12x^2 + 6x + 75x^3 + 15x^2 + 30x + 6$$

$$\boxed{4(5x^2 + 2x + 1)^9 (3x^2 + 6)^3 (105x^3 + 27x^2 + 156x + 30)}$$

$$(30) \quad y = \frac{(2x^2 + 3x)^3}{(x^4 - 9)^4} \quad y' = \frac{(x^4 - 9)^4 (3)(2x^2 + 3x)^2 (4x + 3) - (2x^2 + 3x)^3 (4)(x^4 - 9)^3 (4x^3)}{(x^4 - 9)^8}$$

$$y' = (x^4 - 9)^3 (2x^2 + 3x)^2 \left[(x^4 - 9)(3)(4x + 3) - (2x^2 + 3x)(4)(4x^3) \right]$$

$$\frac{(2x^2 + 3x)^2 \left[(x^4 - 9)(12x + 9) - (2x^2 + 3x)(16x^3) \right]}{(x^4 - 9)^5}$$

$$12x^5 + 9x^4 - 108x^3 - 81 - 32x^5 - 48x^4$$

$$-20x^5 - 37x^4 - 108x^3 - 81$$

$$\boxed{- (2x^2 + 3x)^2 (20x^5 + 37x^4 + 108x^3 + 81) \over (x^4 - 9)^5}$$

(13.) $y = x^3 - 3x^2 + 6$

$$\boxed{y' = 3x^2 - 6x}$$

$$\boxed{y'' = 6x - 6}$$

(14.) $y = x^4 - 2x^2 + 2$

$$\boxed{y' = 4x^3 - 4x}$$

$$\boxed{y'' = 12x^2 - 4}$$

(15.) $y = (2x-1)^5$

$$y' = 5(2x-1)^4(2)$$

$$\boxed{-10(2x-1)^4}$$

$$y'' = 40(2x-1)^3(2)$$

$$\boxed{80(2x-1)^3}$$

(16.) $y = (4-x)^4$

$$y' = 4(4-x)^3(-1)$$

$$\boxed{-4(4-x)^3}$$

$$y'' = \boxed{+12(4-x)^2}$$

(17.) $y = (x^2-1)^4$

$$y' = 4(x^2-1)^3(2x)$$

$$\boxed{8x(x^2-1)^3}$$

~~$y'' = 24x(x^2-1)^2(2x)$~~

$$\boxed{8(2x^4-4x^2+1)}$$

(18.) $y = \frac{1}{x^2+1} = (x^2+1)^{-1}$

$$y' = \boxed{-(x^2+1)^{-2}(2x)}$$

silly me: $y'' = -(x^2+1)^{-2}(2) + (2x)(2)(x^2+1)^{-3}(2x)$

$$\frac{-2}{(x^2+1)^2} + \frac{8x^2}{(x^2+1)^3}$$

$$y'' = 8x(3)(x^2-1)^2(2x) + (x^2-1)^3(8) \cdot \frac{2}{(x^2+1)^2} \left[-1 + \frac{4x^2}{(x^2+1)} \right]$$

$$48x^2(x^2-1)^2 + 8(x^2-1)^3$$

$$8(x^2-1)^2 [6x^2 + (x^2-1)]$$

$$\boxed{8(x^2-1)^2(7x^2-1)}$$

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

$$\left(\frac{2}{(x^2+1)^2} \right) \left(\frac{3x^2-1}{x^2+1} \right) \boxed{\frac{6x^2-2}{(x^2+1)^3}}$$

$$\textcircled{19.} \quad y = \frac{1}{1-x} = (1-x)^{-1} \quad \textcircled{20.} \quad y = \frac{1}{(1-x)^2} = (1-x)^{-2}$$

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

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

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

 $= y^2$

$$\textcircled{21.} \quad y = (1-x)^2$$

$$y' = 2(1-x)(-1)$$

$$= -2(1-x)$$

$$= -2\sqrt{y}$$

$$\textcircled{22.} \quad y = (1+x)^2$$

$$y' = 2(1+x)$$

$$= 2\sqrt{y}$$