Differentiation worksheet #1 for Calculus 1

Use the limit definition of derivative to differentiate the following functions:

(1) $x + 1$
(2) $2/x$
(3) $x^2 + x$
(4) $\sqrt{x-4}$
(5) $\dfrac{x}{x+1}$ (without simplifying first!)

Here is a list of differentiation rules:

A. Power Rule B. Chain Rule
C. Product Rule D. Quotient Rule

For each given function, mark which differentiation rule you would apply *first*.

(6) $x^{3.2}$
(7) $x^2 - x^4$
(8) $\dfrac{\pi x}{6}$
(9) $x^2\sqrt{x^4+1}$
(10) $\cos(x^4)$
(11) $\dfrac{x}{1-x}$
(12) $(x + x^{1/2})(\cos(x) + x^{1/3})$
(13) $\cos^4(x)$
(14) $\cos(x^4) - 2\sin(x)$
(15) x^π

You are given the following information: f and g are continuous differentiable functions such that $f(5) = 3$, $g(5) = 4$, $f'(5) = 7$, $g'(5) = -2$. Find $h(5)$ and $h'(5)$ for each of the following functions h:

(16) $h = f + g$
(17) $h = f - g$
(18) $h = 2f/g$
(19) $h = g^2 - 3g$
(20) $h = \sqrt{f + f * g}$
(21) $h = \dfrac{f^2 + g}{f + g}$

Find the derivative. Show **every** time you use one of the rules A–D above.

Example. To find the derivative of $x^3 + \sin(x)$:

$$\begin{aligned}\frac{d}{dx}(x^3 + \sin(x)) &= \frac{d}{dx}(x^3) + \frac{d}{dx}(\sin(x)) \\ &= 3x^2 + \cos(x) \qquad \text{A. power rule}\end{aligned}$$

(22) $x^{3.2}$
(23) $x^5 + 2x^{4.3} + \frac{1}{4}x^{1/3}$
(24) $-x^{2+1}$
(25) -5
(26) $5/x^2$
(27) $25 - \frac{x}{3}$
(28) $\sqrt[3]{x} + \sqrt[4]{x}$
(29) $1/x^{-0.4}$
(30) $\dfrac{\pi x}{6}$
(31) $x^\pi - \pi x$
(32) $x^{-7} - 7x^{-1}$
(33) $\dfrac{3}{4}x^{-4/7} + 3x^{-\pi}$
(34) $x^{\sqrt{5}} + \sqrt{5x}$
(35) $ax^2 + bx + c$, where a, b, c are constants
(36) $5\cos(x) - 2\cos(x)$