Problem 1: Find all values of $x$ at which the tangent line to the given curve satisfies the stated property.

5. $y = \frac{x+3}{x+2}$; perpendicular to the line $y = 4x$

6. $y = \frac{2x+5}{x+2}$; $y$-intercept of "2"
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(2) \( y = \frac{1}{x+4} \) passes thru the origin.

Problem 2 (a) Show that the segment of the tangent line to the graph of \( y = \frac{1}{x} \) that is cut-off by the coordinate axes is bisected by the point of tangency.
(b) Show that any two tangent lines to the parabola \( y = ax^2 \), \( a \neq 0 \), intersect at a point that is on the vertical line halfway between the points of tangency.
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Problem #3: Find \( f'(x) \).

(a) \( f(x) = \sqrt{3x - \sin^2(4x)} \)

(b) \( f(x) = \frac{\sin x}{\sec(3x+1)} \)
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(i) \( f(x) = x^5 \sec \left( \frac{1}{x} \right) \)

(ii) \( f(x) = \ln \left( \ln \left( \ln(x) \right) \right) \)

(iii) \( f(x) = \log \left( 1 - \sin^2(x) \right) \)
Problem 4: Find the slope of the tangent line to the given curve at the given point by solving for $y$ explicitly in terms of $x$ and then differentiating, and then by using implicit differentiation.

$a \quad x^2 + y^2 = 25 \quad (3, 4)$
(b) \( \frac{1}{\sqrt{x}} + \frac{1}{\sqrt{y}} = 1 \quad (4, 4) \)
Problem 5: Find $\frac{dy}{dx}$

$y = \sqrt{\frac{x-1}{x+1}}$
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b) \[ y = \log_{\ln x} 15 \]
Problem 6: Find \( \frac{d^2y}{dx^2} \)

(2) \( xy + y^2 = 2 \)
Problem 7: Let \( y = \ln(\tan x) \)

(a) Find the equation of the tangent line to the graph of \( y(x) \) at the point \( (\pi/4, 0) \).

(b) Sketch the tangent line to the graph of \( y(x) \) at the point \( (\pi/4, 0) \) on the figure below.