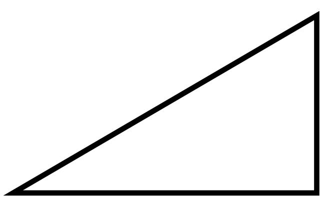
1. (30 points) The following problems are not related.
   (a) (10 points) Find the derivative of $g(x) = \sin\left(\frac{x^2 + x}{3x - 1}\right)$. Do not simplify your answer.
   (b) (14 points) Let $f(x) = \sqrt{4 - x}$.
      i. State the limit definition of the derivative for a function $f(x)$.
      ii. Find $f'(x)$ by using the definition of the derivative. *You must use the limit definition to receive any credit.*
   (c) (6 points) If $f'(x) = \lim_{h \to 0} \frac{\sin(x + h) - \sin(x)}{h}$, find $f'(\ =3)$.
2. (20 points) The following problems are not related.
   (a) (8 points) The side length h of a square is measured as 3 cm, with a maximum error of 0.1 cm. Use differentials to estimate:
      i. the maximum error for the area of the square;
      ii. the relative error for the area of the square.
   (b) (12 points) You are flying a kite which has a constant height of 4 meters above the ground. The wind is carrying the kite horizontally away from you, and you have to let out string at a rate of 2 meters/minute. What is the horizontal speed of the kite when you have let out 5 meters of string?



3. (16 points) Consider the function $s(x) = -x^3 + 3x + 2$.
   (a) Find the critical numbers of $s(x)$.
   (b) Use the first derivative test to determine the points where $s(x)$ has a local maximum or local minimum. *Give your answer as ordered pairs (x, y).*
   (c) Find the absolute maximum and minimum values for the function $s(x)$ on the interval $[0, 2]$.
4. (18 points) Suppose that y is defined implicitly as a function of x from the equation

$$\cos(\ y) = \frac{1}{2}x + y\cos(\ x).$$

   (a) F[illegible] the [illegible]riv[illegible]e $\frac{d}{d}$[illegible]
   (b) [illegible] n [illegible] for [illegible] tangent line to this curve at the point where $y = 0$.
5. (1[illegible]) [illegible] the fu[illegible]tion $f(x) = \frac{1}{x}$ on the interval $[2, 4]$.
   (a) =(8 points) [illegible]ate the M[illegible] Value Theo0/F43 394ltesimpli-250(the)-250(function)]5aF37 10.90i!Td [(0(the]TJ/F67)s]TJs