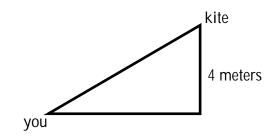
- 1. (30 points) The following problems are not related.
 - (a) (10 points) Find the derivative of $g(x) = \sin \frac{x^2 + x}{3x 1}$. Do not simplify your answer.
 - (b) (14 points) Let $f(x) = \sqrt[1]{4} x$.
 - i. State the limit definition of the derivative for a function f(x).
 - ii. Find $f^{\vartheta}(x)$ by using the definition of the derivative. You must use the limit definition to receive any credit.

(c) (6 points) If
$$f^{\ell}(x) = \lim_{h \neq 0} \frac{\sin(x+h) - \sin(x)}{h}$$
, find $f^{\ell}(-3)$

- 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

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

tangent line to this curve at the point where y = 0.

tion
$$f(x) = \frac{1}{x}$$
 on the interval [2;4].

Value Theo0/F43 394Itesimpli-250(the)-250(function)]5aF37 10.90i!Td [(0(the]TJ/F67)s]TJs

