

# SOLUTIONS

Math 120

Winter 2009

## Quiz #2

1. In this problem, the function  $p(x)$  will always refer to the function defined by the formula:

$$p(x) = \frac{k \cdot x}{x + k},$$

where the letter  $k$  refers to a fixed, constant number.

**NOTE:** In this problem you **SHOULD SIMPLIFY YOUR ANSWERS** as much as possible.

- (a) (1 point) Evaluate:  $p(k)$ .

$$p(k) = \frac{k^2}{2k} = \frac{k}{2}$$

- (b) (1 point) Evaluate:  $p\left(\frac{1}{k}\right)$ .

$$p\left(\frac{1}{k}\right) = \frac{k \cdot \frac{1}{k}}{\frac{1}{k} + k} = \frac{1}{\frac{1 + k^2}{k}} = \frac{k}{1 + k^2}$$

- (c) (1 point) What is the DOMAIN of the function  $p(x)$ ?

The domain of  $p(x)$  includes all real numbers with the exception of  $x = -k$ .

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2. In this problem, the functions  $f(x)$  and  $g(x)$  will always refer to the functions defined by the formulas:

$$f(x) = -(x-1)(x-7) \quad \text{and} \quad g(x) = 1 + \sqrt{x+7}.$$

The domain of  $f(x)$  consists of all numbers and the domain of  $g(x)$  consists of all numbers greater than or equal to  $-7$ .

- (a) (1 point) Write down a formula for the composite function  $f(g(x))$ .

$$f(g(x)) = -\left(1 + \sqrt{x+7} - 1\right)\left(1 + \sqrt{x+7} - 7\right)$$

(Many other answers are possible if this is simplified.)

- (b) (1 point) Write down a formula for the composite function  $g(f(x))$ .

$$\begin{aligned} g(f(x)) &= 1 + \sqrt{-x^2 + 8x - 7 + 7} \\ &= 1 + \sqrt{x(8-x)} \end{aligned}$$

Domain: Need  $x \cdot (8-x) \geq 0$

This occurs between  $x=0$  and  $x=8$ .

The domain is  $0 \leq x \leq 8$ .

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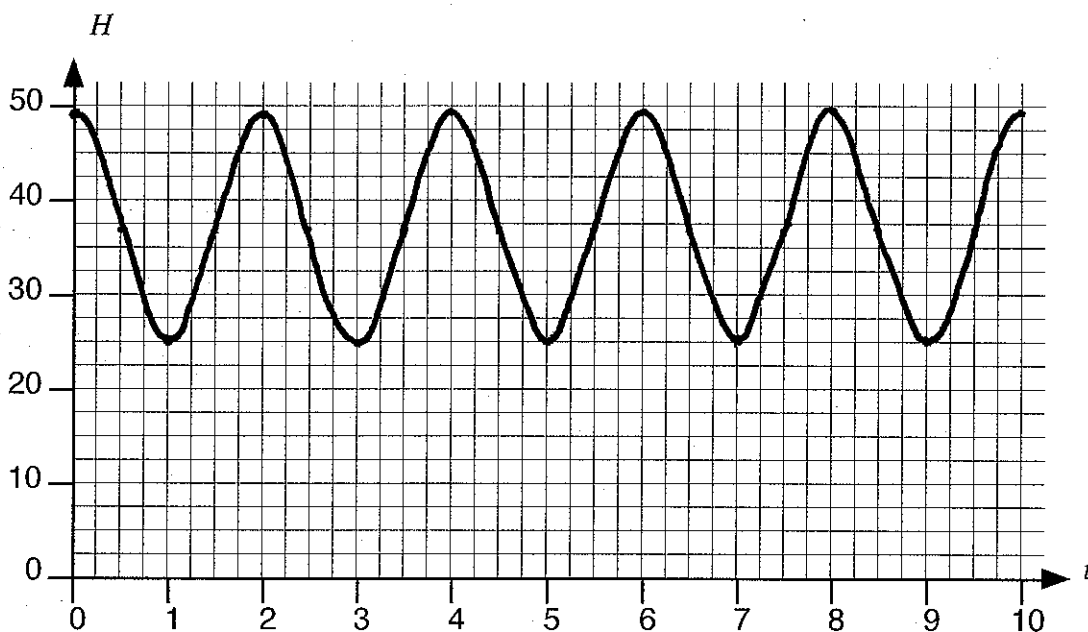
3. At noon, a fly lands on the end of the blade of a windmill just as this blade points straight up. The fly sits and rides the windmill blade for three revolutions. Suppose that the windmill is turning at a rate of 30 revolutions per hour, each blade of the windmill is 12 feet long and the tip of the blade clears the ground by 25 feet.

- (a) (1 point) How high is the fly above the ground at noon?



$$\text{Height} = 25 + 12 + 12 = 49 \text{ feet.}$$

- (b) (2 points) Use the axes provided below to draw a graph showing the height,  $H$ , of the fly above the ground  $t$  minutes after noon.



- (c) (2 points) Write down a formula for  $H(t)$ , the height of the fly above the ground  $t$  minutes after noon.

$$\text{Period} = 2 \quad \text{Amplitude} = 12 \quad \text{Midline} = 37.$$

$$H(t) = 12 \cdot \cos\left(\frac{2\pi}{2}t\right) + 37$$