

## Question 1

The production of Soma requires two inputs, called carisoprodol and alginic acid. If  $x$  units of carisoprodol are combined with  $y$  units of alginic acid, the total output of Soma is  $f(x, y) = x^{1/4}y^{3/4}$ . Suppose a unit of carisoprodol costs \$1 and a unit of alginic acid costs \$3.

1. Find the minimum cost combination of carisoprodol and alginic acid to produce 1 unit of Soma.
2. Find the minimum cost combination of carisoprodol and alginic acid to produce  $q$  units of Soma.
3. What kind of returns to scale does the Soma production technology exhibit?

## Question 2

The production of Soma requires two inputs, called carisoprodol and alginic acid. If  $x$  units of carisoprodol are combined with  $y$  units of alginic acid, the total output of Soma is  $f(x, y) = x^{1/4}y^{3/4}$ . Suppose a unit of carisoprodol costs \$1 and a unit of alginic acid costs \$3. The demand for Soma as a function of its unit price  $p$ , is  $100 - p$ .

1. Suppose Soma is sold by a monopolist. What volume of Soma should it produce to maximize profit?
2. What combination of carisoprodol and alginic acid should be purchased to maximize profit?

## Question 3

Bunter was asked the following:

The production of Soma requires two inputs, called carisoprodol and alginic acid. If  $x$  units of carisoprodol are combined with  $y$  units of alginic acid, the total output of Soma is  $f(x, y) = (x + y)^2$ . Suppose a unit of carisoprodol costs \$c and a unit of alginic acid costs \$a. What kinds of returns to scale does this production technology exhibit?

Here is his solution:

If you acquire  $x$  units of carisoprodol and  $y$  units of alginic acid, the cost will be  $cx + ay$ . As this is linear in  $x$  and  $y$ , the second derivative of cost will be zero. So, we have constant returns to scale.

Is Bunter correct? If not, what is the error that Bunter has made and what is the correct answer?

## Question 4

Consider a monopolist facing an inverse demand curve of the form  $p = 50 - 0.5q$  where  $q$  is the monopolist's output. Suppose the monopolist has a constant marginal cost of production of \$2 a unit. Bunter was asked to determine the quantity which would minimize consumer surplus. Here is his solution:

Consumer surplus as a function of  $q$  is  $\int_0^q (50 - 0.5x)dx - (50 - 0.5q)q$ . The derivative of this with respect to  $q$  is  $(100 - 0.5q) - (50 - q)$ . The FOC is

$$(100 - 0.5q) - (50 - q) = 0 \Rightarrow 50 + 0.5q = 0.$$

There is no solution so this problem does not have a solution.

Is Bunter correct? If not, what is the error that Bunter has made?