

Answer all six questions from this section.

## Question 1

(25 marks)

In a competition Mary has a probability of  $\frac{1}{20}$  of winning, a probability of  $\frac{1}{10}$  of finishing in second place, and a probability of  $\frac{1}{4}$  of finishing in third place. If she wins the competition she gets €9000. If she comes second she gets €7000 and if she comes third she gets €3000. In all other cases she gets nothing. Each participant in the competition must pay €2000 to enter.

(a) Find the expected value of Mary's loss if she enters the competition.

$x = \text{winnings}$	9000	7000	3000	0
$P(x)$	$\frac{1}{20}$	$\frac{1}{10}$	$\frac{1}{4}$	0
$x \cdot P(x)$	450	700	750	0

$E(x) = 450 + 700 + 750 + 0 = 1900$

Cost 2000 to enter

$\therefore$  Expected value of loss = €100

(b) Each of the 3 prizes in the competition above is increased by the same amount (€ $x$ ) but the entry fee is unchanged.

For example, if Mary wins the competition now, she would get €(9000 +  $x$ ).

Mary now expects to break even.

Find the value of  $x$ .

$$(9000 + x)\left(\frac{1}{20}\right) + (7000 + x)\left(\frac{1}{10}\right) + (3000 + x)\left(\frac{1}{4}\right) = 2000$$

$$450 + 0.05x + 700 + 0.1x + 750 + 0.25x = 2000$$

$$0.4x = 100$$

$x = 250$