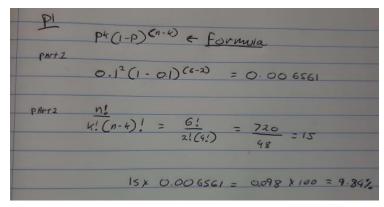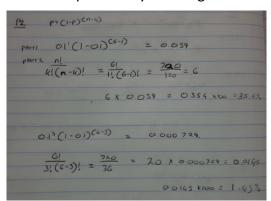1. Suppose you play the game of shooting. You shoot 6 times, each time to a different enemy, and each shot has a 10% chance of success.

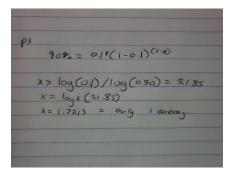1) What's the probability of killing two enemies out of six?

P1

$P^k(1-p)^{(n-k)}$ ← formula

part 2

$0.1^2(1-0.1)^{(6-2)} = 0.006561$

part 2

$\dfrac{n!}{k!(n-k)!} = \dfrac{6!}{2!(4!)} = \dfrac{720}{48} = 15$

$15 \times 0.006561 = 0.098 \times 100 = 9.84\%$

2) What's the probability of killing at most three enemies out of six?

P2 $P^k(1-p)^{(n-k)}$

part 1 $0.1^1(1-0.1)^{(6-1)} = 0.059$

part 2 $\dfrac{n!}{k!(n-k)!} = \dfrac{6!}{1!(6-1)!} = \dfrac{720}{120} = 6$

$6 \times 0.059 = 0.354 \times 100 = 35.4\%$

Ans $= 9.84 + 35.4 + 1.45 = 46.69\%$

$0.1^3(1-0.1)^{(6-3)} = 0.000729$

$\dfrac{6!}{3!(6-3)!} = \dfrac{720}{36} = 20 \times 0.000729 = 0.0145$

$0.0145 \times 100 = 1.45\%$

3) What's the maximum number of enemies we can kill with 90% probability?

 Answer: We can kill 1 enemy

P3

$90\% = 0.1^k(1-0.1)^{(6-k)}$

$x > \log(0.1)/\log(0.90) = 21.85$
$x = \log_6(21.85)$
$x = 1.7213 =$ only 1 enemy.

2. Suppose there is only one enemy and two success shots can kill the enemy. Each shot has a 10% chance of success. How many times do you need to shoot to kill the enemy with 80% probability?

$$P(X = x) = \binom{n}{x}(0.1)^x (0.9)^{n-x}$$

$$1 \& -P(x=0) > 0.8$$

$$1 \& -\binom{n}{0}(0.1)^0 (0.9)^{n-0} > 0.8$$

$$1 - (0.9)^n > 0.8$$

$$0.2 > (0.9)^n$$

Solving using logarithms

$$\log(0.2) > \log(0.9)^n$$

$$\log(0.2) > n \log(0.9)$$

$$\frac{\log(0.2)}{\log(0.9)} > n$$

↖
negative

$$n = \frac{\log(0.2)}{\log(0.9)} = 15.27$$

Ans = 16