Finance Question 2.

Black-Scholes Call Price

$$C = Se^{-\delta T} N(d_1) - Ke^{-rT} N(d_2)$$

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + T\left(r - \delta + \frac{\sigma^2}{2}\right)}{\sigma\sqrt{t}}, \quad d_2 = d_1 - \sigma\sqrt{t}$$

According to Question;

$S$ = Current Price of Underlying Asset (share price) = \$40

$K$ = Call option / Excercise Price = \$45

$r$ = ~~risk~~ ~~mean ret~~ 7% / yr = 0.07

$\delta$ = 3% / year = 0.03

$T = t$ = 4 months = 4/12 = 0.333

$\sigma$ = volatility of share price = 40% / year = 0.4

$N(d)$ = area under normal curve up to $d$ (Determined by distribution / statistical table.

$e$ = constant = 2.718~~28~~, $\ln$ = $\log_e$

$$\Rightarrow d_1 = \frac{\ln\left(\frac{S}{K}\right) + T\left(r - \delta + \frac{\sigma^2}{2}\right)}{\sigma\sqrt{t}}$$

$$d_1 = \frac{\ln\left(\frac{40}{45}\right) + 0.333\left(0.07 - 0.03 + \frac{0.4^2}{2}\right)}{0.4\sqrt{0.333}}$$

$$d_1 = \frac{-0.1165 + 0.03996}{0.0727} = -1.058$$

$$\Rightarrow d_2 = d_1 - \sigma\sqrt{t} = -1.058 - 0.4\sqrt{0.333}$$

$$= -1.058 - 0.231 = -1.289$$

Using cummulative normal distribution calculater (statistical table)

$$N(d_1) = N(-1.058) = 0.1446$$

$$N(d_2) = N(-1.289) = 0.0985$$

Black Scholes Call Price

$$C = Se^{-\delta T} N(d_1) - Ke^{-rT} N(d_2)$$

$$= \$40 e^{-(0.03 \times 0.333)} (0.1446) - \$45 e^{-(0.07 \times 0.333)} \times 0.0985$$

$$= \$40 \times 0.99 \times 0.1446 - \$45 \times 0.997 \times 0.0985$$

$$= \$5.73 - \$4.33 = \$1.4$$

Black Scholes Call Price is $1.4