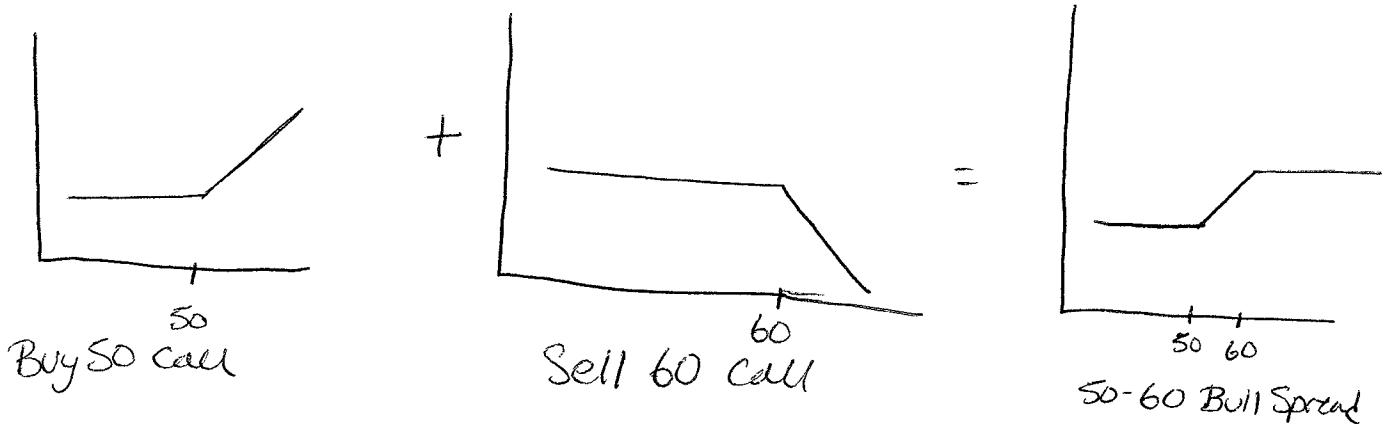


#31 Solution

50-60 Bull Spread:



$$\Delta_{\text{portfolio}} = \Delta_{\text{call } 50} - \Delta_{\text{call } 60}$$

Buy call = Positive Delta, Sell call = Negative Delta

$$\Delta_{\text{call}} = e^{-dt} N(d_1)$$

$$d_1 = \frac{\ln(S_0/K) + [r - d + \theta^2(.5)]t}{\theta\sqrt{t}}$$

Current Delta:

$$d_1(50) = \frac{\ln(50/50) + (.05 + .5(.2^2)) \cdot 1/4}{\sqrt{1/4} (.2)}$$

Given:

$$\boxed{S_0 = 50, r = .05, d = 0, \theta = .2, t = 1/4}$$

$$N(d_1(50)) = .5714$$

$$\Delta_{\text{call}(50)} = e^{-0(1/4)} (.5714) = .5714$$

$$d_1(60) = \frac{\ln(50/60) + (.05 + .5(.2^2)) \cdot 1/4}{\sqrt{1/4} (.2)} = -1.648$$

$$N(d_1(60)) = .0495$$

$$\Delta_{\text{call}(60)} = e^{-0(1/4)} (.0495) = .0495$$

$$\text{Current } \Delta_{\text{portfolio}} = .5714 - .0495 = .5219$$

After 1 month:

$$\text{Now } t = 2/12$$

$$d_1(50) = \frac{\ln(50/50) + [.05 + .5(.2^2)]^{1/2}}{\sqrt{2/12} * .2} = .1429$$

$$N(d_1(50)) = .5557$$

$$\Delta_{\text{call}}(50) = .5557$$

$$d_1(60) = \frac{\ln(50/60) + [.05 + .5(.2^2)]^{1/2}}{\sqrt{2/12} * .2} = -2.0901$$

$$N(d_1(60)) = .0183$$

$$\Delta_{\text{call}}(60) = .0183$$

$$\text{After 1 mo. } \Delta_{\text{portfolio}} = .5557 - .0183 = .5374$$

So Δ changes

$$.5374 - .5219 = .0155$$

\therefore it increases by $\sim .02$ (B)

For a more precise answer use a normal calculator
From the prometric website

www.prometric.com/soa/mfe3f-calculator.htm