M339D: February 13th, 2023.

$K=80$

Problem 5.4. The current price of stock a certain type of stock is $\boxed{\$80}$. The premium for a $\boxed{\text{6−month,}}$ $\boxed{\text{at-the-money}}$ call option is $\boxed{\$5.84}$. Let the continuously compounded, risk-free interest rate be 0.04. What is the break-even point of this call option?

(a) \$80
(b) \$85.72
(c) \$85.84
(d) \$85.96
(e) None of the above.

$\boxed{S(0)=K}$

$$S^* = K + FV_{0,T}(V_C(0))$$
$$= 80 + 5.84e^{0.04(0.5)} = \underline{85.96}$$

Problem 5.5. The price of gold in half a year is modeled to be equally likely to equal any of the following prices

$$\$1000, \quad \$1100, \quad \text{and} \quad \$1240.$$

Consider a half-year, $\boxed{\$1050\text{-strike}}$ European call option on gold. What is the expected payoff of this option according to the above model?

→ :

$(S(T)-K)_+$	0	50	190
w/ probab.	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$

answer: $50 \cdot \left(\frac{1}{3}\right) + 190 \cdot \left(\frac{1}{3}\right) = \boxed{80}$

$\square$

Problem 5.6. (5 points) The "Very tasty goat cheese Co" sells artisan goat cheese at \$10 per oz. They need to buy 200 gallons of goat milk in six months to make 200 oz of their specialty fall-equinox cheese. Non-goat milk aggregate costs total \$500. They decide to buy six-month, \$5-strike call options on gallons of goat milk for 0.50 per call option.

The continuously compounded risk-free interest rate equals 0.04.

In six months, the price of goat milk equals \$6 per gallon. What is the profit of the company's hedged position?

(a) 395.92

(b) 397.98

(c) 400

(d) 897.98

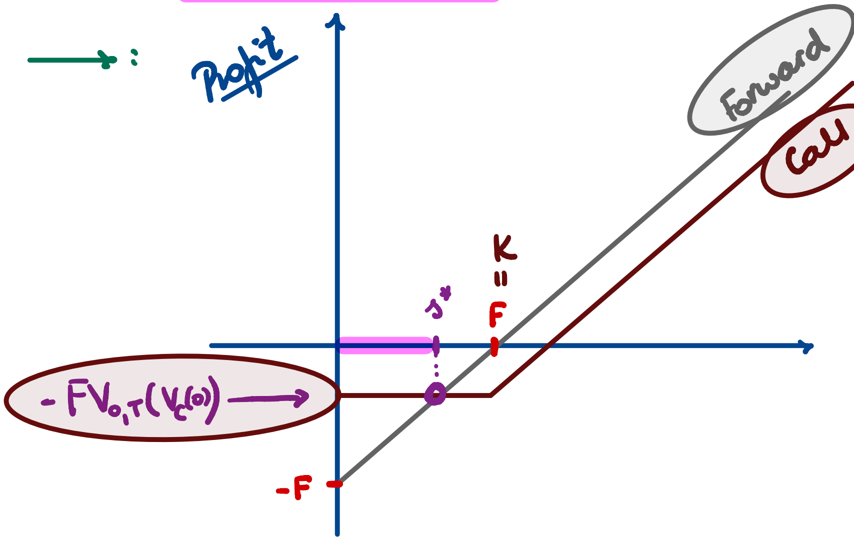
(e) None of the above.

$$200(10) - 500 - 200(.50e^{.04(.5)}) - 5(200)$$

$$= 397.98$$

Problem 5.7. For what values of the final asset price is the $\boxed{\text{profit of a long forward contract}}$ with the forward price $F = 100$ and delivery date T in one year smaller than the profit of a long call on the same underlying asset with the strike price $K = 100$ and the exercise date T. Assume that the call's premium equals \$10 and that the annual effective interest rate equals 10%.

Express your asnwer as an interval.



$s^* = ?$

Solve for s:

$$s - 100 = -10(1+0.10)$$
$$= -11$$

$$\boxed{s^* = 89}$$

answer: $[0, 89)$

Problem 5.8. *Source: Sample IFM (Derivatives - Intro), Problem#11*
The current stock price is \$40, and the effective annual interest rate is 8%.

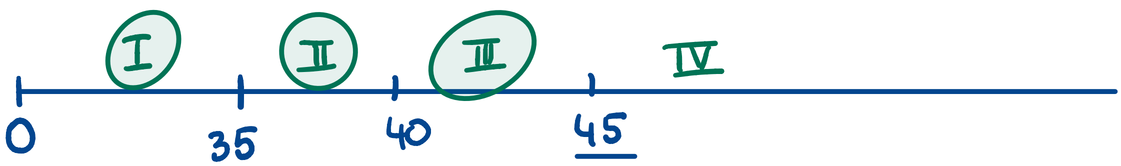
You observe the following option prices:

(1) The premium for a \$35-strike, 1-year European call option is \$9.12.
(2) The premium for a \$40-strike, 1-year European call option is \$6.22.
(3) The premium for a \$45-strike, 1-year European call option is \$4.08.

Assuming that all call positions being compared are **long**, at what 1-year stock price range does the \$45-strike call produce a higher profit than the \$40-strike call, but a lower profit than the \$35-strike call? Express your answer as an interval.

→ : $(s-40)_+ - 6.22(1.08) < (s-45)_+ - 4.08(1.08) < (s-35)_+ - 9.12(1.08)$

$(s-40)_+ - 6.72 < (s-45)_+ - 4.41 < (s-35)_+ - 9.85$



I $-6.72 < \boxed{-4.41 < -9.85}$ No sol'ns here.

II. $\underline{0 - 6.72 < 0 - 4.41} < s - 35 - 9.85$

✓

$-4.41 < s - 44.85$

$\boxed{40.44 < s}$ Doesn't work (yet!)

III. $s-40-6.72 < 0 - 4.41 < s - 35 - 9.85$

$\boxed{40.44 < s}$:)

$s - 46.72 < -4.41$

$\boxed{s < 42.31}$ → $40.44 < s < 42.31$

$\boxed{(40.44, 42.31)}$

IV.

$\cancel{8}-40-6.72 < \cancel{8}-45-4.41 < \cancel{8}-35-9.85$

$\underline{-46.72 < -49.41} < -44.85$ ✓

$\emptyset$