

1.1 a) $S_0 = \$500$ $\%_{02}$, $r = 0.035$, $T = 1$ year

First check for arbitrage.

$$F_0^* = S_0 e^{rT}$$

Plugging in $F_0^* = \$500 e^{0.035 \cdot 1}$
 $\approx \$5229.88$

Fair Forward is $\$5229.88$

The forward is $\$5200 < \5229.88

\Rightarrow So Arbitrage exists

In order to realize the arbitrage,

At $t=0$ short 1 oz of gold

Invest the $\$500$ at 0.035 , buy a bond

Go long 1 forward with delivery price $\$5200$

At $t=1$ for each ounce, the arbitrage profit would be

$\boxed{\$29.88 \text{ per oz}}$



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1.1 b.) If the market forward is 5300, there is an arbitrage opportunity since $5300 > 5229.88$

Borrow $S_0 = 5050$ and buy one ounce of gold
Short one forward with delivery $F_0 = 5300$

At $t=0$, Borrow +5050, Buy gold - 5050,
Enter forward

At $t=1$, Deliver gold into the forward and receive
+5300 and repay the loan - 5229.88

So the arbitrage profit is $\boxed{\$70.12 \text{ per oz}}$

1.2) a.) The growth factor is $(1 + \frac{r}{m})^m$ where
 r is the rate and m is the compounding
factor

After 1 year, $(1 + \frac{0.0328}{2})^2 = 1.0328$

So the annual rate is $\boxed{3.28\%}$ ~~per year~~



1.2(b.) With quarterly compounding,

$$\left(1 + \frac{r}{4}\right)^4 = 1.0328$$

$$1 + \frac{r}{4} \approx (1.008084 - 1)^4$$

$$r = 0.03236$$

So the quarterly rate is $\boxed{3.236\%}$

c.) For continuously,

$$e^{R_c} = 1.03278$$

$$R_c = \ln(1.03278)$$

$$R_c = 0.03224$$

So the continuously compounding rate is $\boxed{3.224\%}$

1.3 Balance = 10,000 07.15% for excellent credit

Daily compound rate $B_t = B_0 \left(1 + \frac{APR}{365}\right)^t$

$$B_{30} = 10000 \left(1 + \frac{0.0715}{365}\right)^{30} = 10,141.90$$

So the Balance would be $\boxed{\$10,141.90}$



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1.4% Coupon per half-year $C = \frac{0.05}{2} \cdot 100 = 2.5$
 let $F = 100$, face value

Semiannual payment at $t = 0.5, 1.0, 1.5, 2.0$

$R = 3.0\%$ $t \leq 1$, $R = 3.5\%$ for $1 < t$,

$$\text{Bond} = 2.5e^{-0.03(0.5)} + 2.5e^{-0.03(1.0)} + 2.5e^{-0.035(1.5)} + 102.5e^{-0.035(2.0)}$$

Assuming continuous compounding,

$$\begin{aligned} \text{Bond} &= 2.5(0.9851119) + 2.5(0.9704455) + 2.5(0.9488) + 102.5 \\ &= \boxed{102.83 \text{ for } 100 \text{ face}} \end{aligned}$$

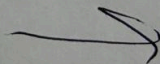
b) $C = \frac{0.06}{2} = 3$, for 10 years there are ~~10~~ ²⁰ ~~per~~ ^{per year} ~~times~~

$$P_2 = 3(e^{-0.03(0.5)} + e^{-0.03(1.0)} + e^{-0.035(1.5)} + e^{-0.035(2.0)})$$

$$+ 3 \sum_{t \in \{2.5, 3.0, 3.5, 4, 4.5, 5\}} e^{-0.0425t}$$

$$+ 3 \sum_{t \in \{5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5\}} e^{-0.045t}$$

$$+ 103 \sum e^{-0.045 \cdot (10)}$$



1 b.) Adding it up bond 2 = 111.84 per 100 face

c.) Getting bond yields: $C = 2.5$

$$B_1 \Rightarrow 102.83 = \sum_{k=1}^3 \frac{2.5}{(1 + \frac{y}{2})^k} + \frac{102.5}{(1 + \frac{y}{2})^4}$$

Solving gives 0.03521

so the semiannual-compounded rate
for B_1 is 3.521%

$$B_2 \Rightarrow 111.84 = \sum_{k=1}^{19} \frac{3}{(1 + \frac{y}{2})^k} + \frac{103}{(1 + \frac{y}{2})^{20}}$$

$$= 0.04515$$

so the semi annual-compounded rate
for B_2 is 4.515%

1.5 a.) the forward's value to a long position is
Payoff = $(X_T - F_0) \times \text{Notional in EUR}$

$$\text{Plugging in Payoff} = (1.175 - 1.150) \times 1,000,000 = \$25,000$$

so \$25,000 gain at maturity

1.5 (b) $F_0 = X_0 e^{(r_{USD} - r_{EUR})T}$ for continuous compounding

$$r_{USD} - r_{EUR} = \frac{1}{T} \ln \left(\frac{F_0}{X_0} \right) \rightarrow \text{solving for differential}$$

plug $\Rightarrow r_{USD} - r_{EUR} = \frac{1}{0.5} \ln \left(\frac{1.150}{1.100} \right) =$

$$2 \ln(1.04545) \approx 2(0.04445) = 0.0889$$

so ~~EUR~~ $r_{USD} - r_{EUR} = 0.0889$

or 8.89% per year
continually compounding