CCA2 Modeling Equations

① $A=P(1+r)^t$

Constant Exponential Equations

Isolate

$\frac{135000}{100000}=\frac{\cancel{100000}(1+r)^5}{\cancel{100000}}$

Radical of both sides

$\sqrt[5]{1.35}=\sqrt[5]{(1+r)^5}$

$1.0618... = \cancel{1}+r$

$-1 \quad \cancel{-1}$

$.0618... = r$

$.0618(100) = 6\%$

② $A=P(1-r)^t$

Constant exponential equation

$\frac{9200}{24320}=\frac{\cancel{24320}(1-r)^7}{\cancel{24320}}$

Isolate

$\sqrt[7]{.378...}=\sqrt[7]{(1-r)^7}$

Radical of both sides

$.8703 = 1-r$

$-1 \quad -1$

$\frac{-.12965...}{-1}=\frac{-r}{-1}$

$.12965... = r$

$.12965(100) = 13\%$

③ $A=P(1+r)^t$

$750(3)=750(1+.03)^t$

Variable exponential equations

$\frac{2250}{750}=\frac{\cancel{750}(1.03)^t}{\cancel{750}}$

Isolate

$3=(1.03)^t$

log of both sides

$\log 3 = \log 1.03^t$

$\frac{\log 3}{\log 1.03}=\frac{t\cancel{\log 1.03}}{\cancel{\log 1.03}}$

$37.167... = t$

37 years $= t$

④ $A=Pe^{rt}$

$\frac{2(500)}{500}=\frac{500e^{.05t}}{500}$

Variable exponential Equation

Isolate

$\frac{1000}{500}=e^{.05t}$

Log of both sides

$\log 2 = \log e^{.05t}$

$\frac{\log 2}{.05\log e}=\frac{\cancel{.05}t\cancel{\log e}}{.05\log e}$

$13.86... = t$

14 years

⑤ $N = 50e^{3t}$

$$\frac{30{,}700}{50} = \frac{\cancel{50}e^{3t}}{\cancel{50}}$$ Exponential Equation

$$614 = e^{3t}$$ Isolate

log of both sides

$$\log 614 = \log e^{3t}$$

$$\frac{\log 614}{3\log e} = \frac{\cancel{3}t\log e}{\cancel{3\log e}}$$

Variable exponential equation
isolate

$$2.14 = t$$

⑦ $A = P\left(\frac{1}{2}\right)^{\frac{t}{h}}$

$A = 7$

$P = 20$

$t = t$

$h = 8.02$

$$\frac{7}{20} = \frac{\cancel{20}\left(\frac{1}{2}\right)^{\frac{t}{8.02}}}{\cancel{20}}$$ Variable exponential equation

$$\frac{7}{20} = \frac{1}{2}^{\frac{t}{8.02}}$$ Isolate

$$\log\frac{7}{20} = \log\frac{1}{2}^{\frac{t}{8.02}}$$ Log of both sides

$$8.02\log\frac{7}{20} = \left(\frac{t}{\cancel{8.02}}\right)\log\frac{1}{2}\ \cancel{8.02}$$ multiply by LCD

$$\frac{8.02\log\frac{7}{20}}{\log\frac{1}{2}} = \frac{t\cancel{\log\frac{1}{2}}}{\cancel{\log\frac{1}{2}}}$$

$$12.14 = t$$

12 days $= t$

⑥ $T = T_a + (T_0 - T_a)e^{-kt}$

$T_a = 325$

$T_0 = 68$

$t = 2$

$T = 100$

$k = K$

$$100 = 325 + (68 - 325)e^{-k(2)}$$

$$-325 \quad -325$$

$$\frac{-225}{-257} = \frac{\cancel{-257}e^{-2k}}{\cancel{-257}}$$

$$\frac{225}{257} = e^{-2k}$$ log of both sides

$$\log\frac{225}{257} = \log e^{-2k}$$

$$\frac{\log\frac{225}{257}}{-2\log e} = \frac{\cancel{-2}k\cancel{\log e}}{\cancel{-2\log e}}$$

$$.066 = k$$

$T_a = 325$

$T_0 = 68$

$t = 8\text{AM} - 3\text{AM} = 7$

$T = T$

$k = .066$

$$T = 325 + (68 - 325)e^{-.066(7)}$$

$$T = 163°$$

(8) $N(t) = N_0(e)^{-rt}$

$A(t) = 800e^{-.347t}$ $B(t) = 400e^{-.231t}$

$800e^{-.347t} = 400e^{-.231t}$

y_1 y_2

2nd Calc (Trace), Intersect

$t = 5.4754067$

$t = 6$

$.15(800) = 120$

$\frac{120}{800} = \frac{800e^{-.347t}}{800}$ Exponential Equation

Isolate

Log of both sides

$.15 = e^{-.347t}$

$\log .15 = \log e^{-.347t}$

$\frac{\log .15}{-.347\log e} = \frac{-.347t\log e}{-.347\log e}$

$5.5 = t$

(9)

Option A:

$A = P(1+r)^t$

$A = A$

$P = 5000$

$r = .045$

$t = n$

$A = 5000(1+.045)^n$

$A = 5000(1+.045)^6$

$A = 6511.30$

Option B

$A = P(1+\frac{r}{n})^{nt}$

$A = B$

$P = 5000$

$r = .046$

$n = 4$

$t = n$

$B = 5000(1+\frac{.046}{4})^{4n}$

$B = 5000(1+\frac{.046}{4})^{4(6)}$

$B = 6578.87$

$6578.87 - 6511.30 = 67.57$

$\frac{10000}{5000} = \frac{5000(1+\frac{.046}{4})^{4n}}{5000}$

Exponential Equation

Isolate

Log of both sides

$2 = 1.0115^{4n}$

$\log 2 = \log 1.0115^{4n}$

$\frac{\log 2}{4\log 1.0115} = \frac{4n\log 1.0115}{4\log 1.0115}$

$15.2 = n$

(10) $S = \sqrt{t} - 2t + 6$

$0 = \sqrt{t} - 2t + 6$ Radical Equation

$+2t - 6$ $+2t - 6$ Isolate

$(2t-6)^2 = (\sqrt{t})^2$ Square both sides

$(2t-6)^2 = t$ Square binomial theorem

$4t^2 - 24t + 36 = t$ Quadratic Equation

$-t$ $-t$ Bring everything to 1 side

$4t^2 - 25t + 36 = 0$ PT

$t^2 - 25t + 144$ $y = \frac{144}{x}$ 2nd Graph (Table) Factor

$\left(t - \frac{16}{4}\right)\left(t - \frac{9}{4}\right)$

$(t-4)(4t-9) = 0$

$t - 4 = 0$ | $4t - 9 = 0$

$+4$ $+4$ | $+9$ $+9$

$t = 4$ | $\frac{4t}{4} = \frac{9}{4}$

$\cancel{t = 2.25}$ check

$0 = \sqrt{4} - 2(4) + 6$ $0 = \sqrt{2.25} - 2(2.25) + 6$

✓ X

$t=1$ $S = \sqrt{1} - 2(1) + 6$

$S = 5$

$t=3$

$S = \sqrt{3} - 2(3) + 6$

$S = 1.73$

$5 - 1.73 = 3.2679...$

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