

Test 1 solution

(a) Difference eqn: $y_n = 1.1 y_{n-1} - 15,000$

$$\text{Solution: } y_n = \frac{-15,000}{1-1.1} + \left(7,000,000 - \frac{-15,000}{1-1.1} \right) (1.1)^n$$

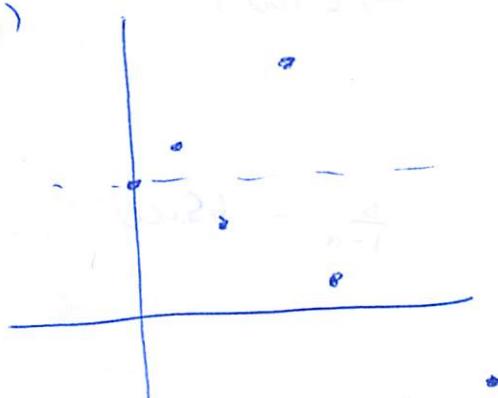
you can simplify, but its not necessary:

$$y_n = 150,000 + (7,000,000 - 150,000) (1.1)^n$$

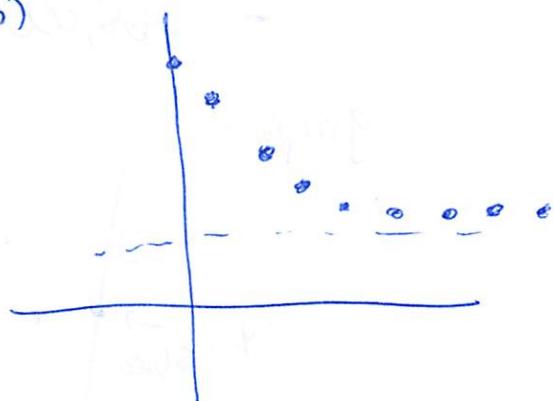
(b) Difference eqn: $y_n = y_{n-1} - 15,000$

$$\text{Solution: } y_n = 7,000,000 - 15,000 \cdot n$$

2. (a)



(b)



$$3. (a) \text{ Interest per month } \left(\frac{12}{100}\right) \cdot \frac{1}{12} = \frac{1}{100}$$

Difference eqn : $y_n = 1.01 y_{n-1} - 650$

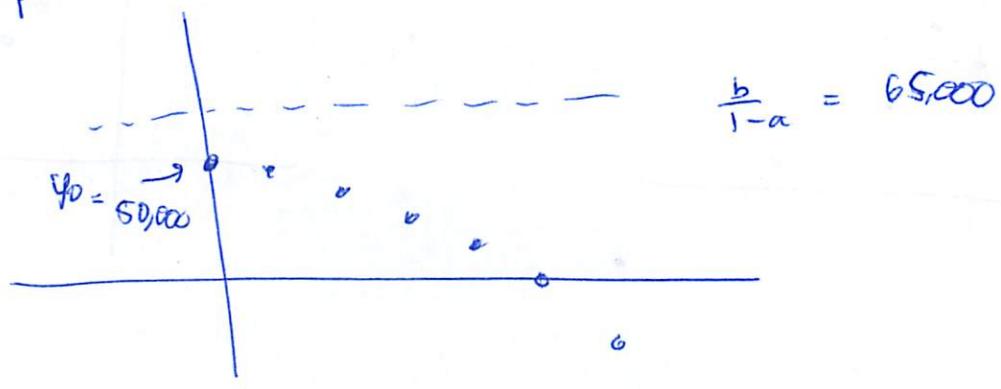
or

$$y_n = \frac{101}{100} y_{n-1} - 650$$

(b)

$$\begin{aligned}
 y_n &= \underbrace{\cancel{y_0 + 650}}_{\cancel{50,000}} + \underbrace{\cancel{1.01}}_{\cancel{101/100}} \cancel{y_0} \\
 &= \frac{-650}{1 - \frac{101}{100}} + \left(50,000 - \frac{-650}{1 - \frac{101}{100}} \right) \left(\frac{101}{100} \right)^n \\
 &= +65,000 + (50,000 - 65,000) \left(\frac{101}{100} \right)^n \\
 &= 65,000 + (-15,000) \left(\frac{101}{100} \right)^n
 \end{aligned}$$

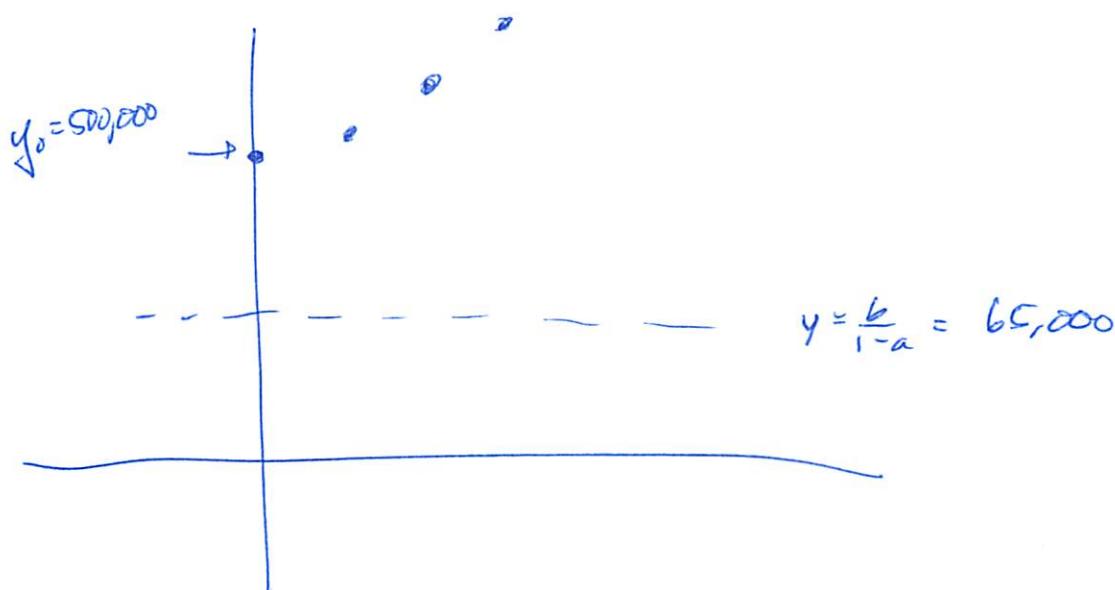
graph:



$$3.(c) \quad y_n = \frac{-650}{1 - \frac{101}{100}} + \left(500,000 - \frac{-650}{1 - \frac{101}{100}} \right) \left(\frac{101}{100} \right)^n$$

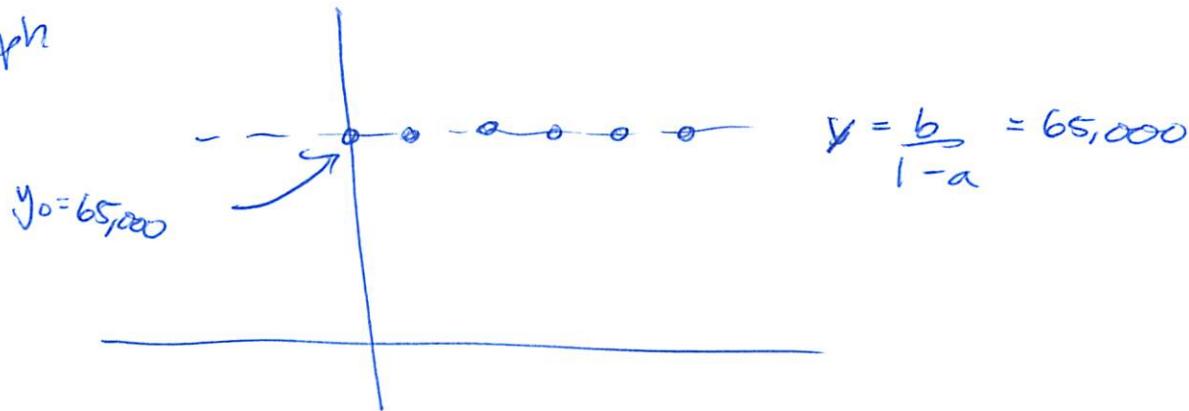
$$= 65,000 + (500,000 - 65,000) \left(\frac{101}{100} \right)^n$$

$$= 65,000 + (435,000) \left(\frac{101}{100} \right)^n$$



3(d) Smallest value for y_0 is when $y_0 = \frac{b}{1-a} = \cancel{65,000}$

Graph



$$9. \text{ monthly interest rate } \left(\frac{10}{100}\right) \frac{1}{12} = \frac{1}{10} \cdot \frac{1}{12} = \frac{1}{120}$$

(a)

$$\text{Difference eqn: } y_n = \frac{121}{120} y_{n-1} + b$$

(b)

$$y_n = \frac{b}{1 - \frac{121}{120}} + \left(90,000 - \frac{b}{1 - \frac{121}{120}} \right) \left(\frac{121}{120} \right)^n$$

simplify:

$$y_n = \frac{b}{\frac{-1}{120}} + \left(90,000 - \frac{b}{\frac{-1}{120}} \right) \left(\frac{121}{120} \right)^n$$

$$y_n = -120b + (90,000 + 120b) \left(\frac{121}{120} \right)^n$$

30 yrs into months $\rightarrow 30 \cdot 12 < 360$

$$0 = -120b + (90,000 + 120b) \left(\frac{121}{120} \right)^{360}$$

$$0 = -120b + 90,000 \cdot \left(\frac{121}{120} \right)^{360} + 120b \cdot \left(\frac{121}{120} \right)^{360}$$

\curvearrowleft

$$-90,000 \cdot \left(\frac{121}{120} \right)^{360} = -120b + 120b \cdot \left(\frac{121}{120} \right)^{360}$$

$$= b \left(-120 + 120 \cdot \left(\frac{121}{120} \right)^{360} \right) \text{ Now divide}$$

Yb continued:

$$b = \frac{-90,000 \cdot \left(\frac{121}{120}\right)^{360}}{\left(-120 + 120 \cdot \left(\frac{121}{120}\right)^{360}\right)} \approx -789,81$$

5.

(a) $f(x) = \frac{1}{x} = x^{-1}$

• $f'(x) = -x^{-2}$

• $y - y_3 + (-\frac{1}{9})(x - 3)$

$f'(3) = -\frac{1}{9}$

$f(3) = \frac{1}{3}$

(b) $f(x) = x^{\frac{3}{7}}$

• $f'(x) = \frac{3}{7} \cdot x^{-\frac{4}{7}}$

• $y - 1 = \frac{3}{7}(x - 1)$

$f(1) = 1$

$f'(1) = \frac{3}{7}$

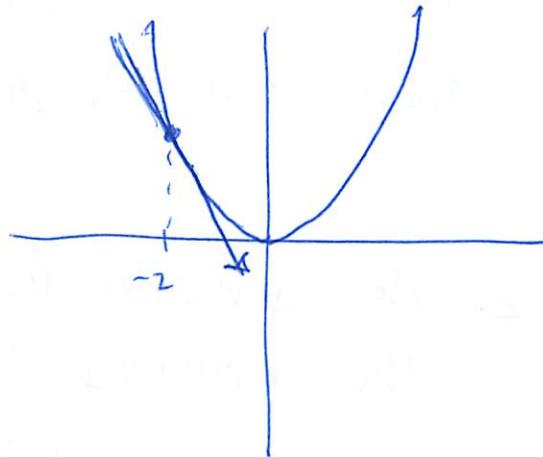
(c) $f(x) = x^2$

• $f'(x) = 2x$

• $y - 4 = -4(x + 2)$

$f'(-2) = -4$

$f(2) = 4$



$$6. \quad \begin{aligned} f(1) &= 0 \\ f'(1) &= 1 \end{aligned}$$

$$\left. \begin{array}{l} \\ \end{array} \right\} \quad y - 0 = 1(x - 1)$$

7.

$$\lim_{h \rightarrow 0} \frac{f(z+h) - f(z)}{h}$$

$$f(x) = x^2 + 4x + 3$$

$$\lim_{h \rightarrow 0} \frac{(z+h)^2 - 4(z+h) + 3 - (z^2 - 4z + 3)}{h}$$

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$$= \lim_{h \rightarrow 0} \frac{4 + 4h + h^2 - 4 - 4h + 3 - 4 + 8 - 3}{h} \quad) \text{ cancel}$$

$$= \lim_{h \rightarrow 0} \frac{4h + h^2 - 4h}{h} = \lim_{h \rightarrow 0} \frac{h^2}{h} = \lim_{h \rightarrow 0} h$$

$$= 0$$