

# Assumptions

→ 0.5 g gold / 1 m<sup>3</sup> paydirt

→ 2 m<sup>3</sup> total / 1 m<sup>3</sup> paydirt

→ \$150 / hr

→ 12 hr / d

→ 30 m<sup>3</sup> total / hr → 15 m<sup>3</sup> paydirt / hr } 15 m<sup>3</sup> / hr cap

→ 25 m<sup>3</sup> paydirt / hr

→ T<sub>initial</sub> = 50% recovery

T<sub>30d</sub> = 90% recovery = T<sub>max</sub>

→ \$60 × .9 0 ~ 5000 g

\$60 × .85 5000 ~ 10000 g

\$60 × .8 10000 ~ ∞ g

→ 160 d total

→ \$150000 fixed cost

→ short time frame (no TVM accounted)

1.  $T_{30d} = T_i \times N^b$

$$b = \log_N \left( \frac{T_{30d}}{T_i} \right) = \log_{30} \left( \frac{.9}{.5} \right)$$

$$= .1728$$

Cost = Fix + Variable

$$= \$150000 + T_N \left( \frac{\$150}{hr} \right) \left( \frac{12 hr}{d} \right) N$$

$$= \$150000 + 10.5 (1728) N$$



$$\text{Gold/day} = T_N \left( \frac{0.5g}{\text{m}^3 \text{ pay dirt}} \right) \left( \frac{15 \text{ m}^3 \text{ pay dirt}}{\text{hr}} \right) \left( \frac{12 \text{ hr}}{\text{d}} \right)$$

$$= \begin{cases} 0.5 N^{0.1728} (1.5) 15 (12) & 1 \leq N < 30 \\ 0.9 (1.5) 15 (12) & 30 \leq N \end{cases}$$

$$\text{Revenue/gold} = \begin{cases} \$60 (.9) & 0 \leq G \leq 5000 \\ \$60 (.85) & 5000 < G \leq 10000 \\ \$60 (.8) & 10000 < G \end{cases}$$

Plot Revenue

$$= \begin{cases} \$60 (.9) G & 0 \leq G \leq 5000 \\ \$60 (.9) 5000 + \$60 (.85) (G - 5000) & 5000 < G \leq 10000 \\ \$60 (.9) 5000 + \$60 (.85) 5000 + \$60 (.8) (G - 10000) & 10000 < G \end{cases}$$

From excel, we know that

$$N \approx 66 \rightarrow G > 5000$$

$$N \approx 128 \rightarrow G > 10000$$

Day	Cost, accumulative (\$)	Gold, each day (g)	Gold, accumulative (g)	Revenue, accumulative (\$)
64.00	265,200.00	81.00	4,849.97	261,898.31
65.00	267,000.00	81.00	4,930.97	266,272.31
66.00	268,800.00	81.00	5,011.97	270,610.41
67.00	270,600.00	81.00	5,092.97	274,741.41

Break even at  $N = \text{day } 66$



## Q1

Day	Cost, accumulative (\$)	Gold, each day (g)	Gold, accumulative (g)	Revenue, accumulative (\$)
1	151,800.00	45.00	45.00	2,430.00
2	153,600.00	50.73	95.73	5,169.24
3	155,400.00	54.41	150.14	8,107.30
4	157,200.00	57.18	207.32	11,195.13
5	159,000.00	59.43	266.75	14,404.35
6	160,800.00	61.33	328.08	17,716.31
7	162,600.00	62.99	391.07	21,117.68
8	164,400.00	64.46	455.53	24,598.46
9	166,200.00	65.78	521.31	28,150.81
10	168,000.00	66.99	588.30	31,768.44
11	169,800.00	68.11	656.41	35,446.15
12	171,600.00	69.14	725.55	39,179.57
13	173,400.00	70.10	795.65	42,965.00
14	175,200.00	71.00	866.65	46,799.23
15	177,000.00	71.86	938.51	50,679.44
16	178,800.00	72.66	1,011.17	54,603.17
17	180,600.00	73.43	1,084.60	58,568.23
18	182,400.00	74.16	1,158.75	62,572.65
19	184,200.00	74.85	1,233.60	66,614.66
20	186,000.00	75.52	1,309.12	70,692.66
21	187,800.00	76.16	1,385.28	74,805.18
22	189,600.00	76.77	1,462.05	78,950.91
23	191,400.00	77.36	1,539.42	83,128.61
24	193,200.00	77.94	1,617.35	87,337.14
25	195,000.00	78.49	1,695.84	91,575.47
26	196,800.00	79.02	1,774.86	95,842.63
27	198,600.00	79.54	1,854.40	100,137.71
28	200,400.00	80.04	1,934.44	104,459.86
29	202,200.00	80.53	2,014.97	108,808.31
30	204,000.00	81.00	2,095.97	113,182.31
31	205,800.00	81.00	2,176.97	117,556.31
32	207,600.00	81.00	2,257.97	121,930.31
33	209,400.00	81.00	2,338.97	126,304.31
34	211,200.00	81.00	2,419.97	130,678.31
35	213,000.00	81.00	2,500.97	135,052.31
36	214,800.00	81.00	2,581.97	139,426.31
37	216,600.00	81.00	2,662.97	143,800.31
38	218,400.00	81.00	2,743.97	148,174.31
39	220,200.00	81.00	2,824.97	152,548.31
40	222,000.00	81.00	2,905.97	156,922.31
41	223,800.00	81.00	2,986.97	161,296.31
42	225,600.00	81.00	3,067.97	165,670.31
43	227,400.00	81.00	3,148.97	170,044.31
44	229,200.00	81.00	3,229.97	174,418.31
45	231,000.00	81.00	3,310.97	178,792.31
46	232,800.00	81.00	3,391.97	183,166.31
47	234,600.00	81.00	3,472.97	187,540.31
48	236,400.00	81.00	3,553.97	191,914.31

## Q1

49	238,200.00	81.00	3,634.97	196,288.31
50	240,000.00	81.00	3,715.97	200,662.31
51	241,800.00	81.00	3,796.97	205,036.31
52	243,600.00	81.00	3,877.97	209,410.31
53	245,400.00	81.00	3,958.97	213,784.31
54	247,200.00	81.00	4,039.97	218,158.31
55	249,000.00	81.00	4,120.97	222,532.31
56	250,800.00	81.00	4,201.97	226,906.31
57	252,600.00	81.00	4,282.97	231,280.31
58	254,400.00	81.00	4,363.97	235,654.31
59	256,200.00	81.00	4,444.97	240,028.31
60	258,000.00	81.00	4,525.97	244,402.31
61	259,800.00	81.00	4,606.97	248,776.31
62	261,600.00	81.00	4,687.97	253,150.31
63	263,400.00	81.00	4,768.97	257,524.31
64	265,200.00	81.00	4,849.97	261,898.31
65	267,000.00	81.00	4,930.97	266,272.31
66	268,800.00	81.00	5,011.97	270,610.41
67	270,600.00	81.00	5,092.97	274,741.41
68	272,400.00	81.00	5,173.97	278,872.41
69	274,200.00	81.00	5,254.97	283,003.41
70	276,000.00	81.00	5,335.97	287,134.41
71	277,800.00	81.00	5,416.97	291,265.41
72	279,600.00	81.00	5,497.97	295,396.41
73	281,400.00	81.00	5,578.97	299,527.41
74	283,200.00	81.00	5,659.97	303,658.41
75	285,000.00	81.00	5,740.97	307,789.41
76	286,800.00	81.00	5,821.97	311,920.41
77	288,600.00	81.00	5,902.97	316,051.41
78	290,400.00	81.00	5,983.97	320,182.41
79	292,200.00	81.00	6,064.97	324,313.41
80	294,000.00	81.00	6,145.97	328,444.41
81	295,800.00	81.00	6,226.97	332,575.41
82	297,600.00	81.00	6,307.97	336,706.41
83	299,400.00	81.00	6,388.97	340,837.41
84	301,200.00	81.00	6,469.97	344,968.41
85	303,000.00	81.00	6,550.97	349,099.41
86	304,800.00	81.00	6,631.97	353,230.41
87	306,600.00	81.00	6,712.97	357,361.41
88	308,400.00	81.00	6,793.97	361,492.41
89	310,200.00	81.00	6,874.97	365,623.41
90	312,000.00	81.00	6,955.97	369,754.41
91	313,800.00	81.00	7,036.97	373,885.41
92	315,600.00	81.00	7,117.97	378,016.41
93	317,400.00	81.00	7,198.97	382,147.41
94	319,200.00	81.00	7,279.97	386,278.41
95	321,000.00	81.00	7,360.97	390,409.41
96	322,800.00	81.00	7,441.97	394,540.41
97	324,600.00	81.00	7,522.97	398,671.41

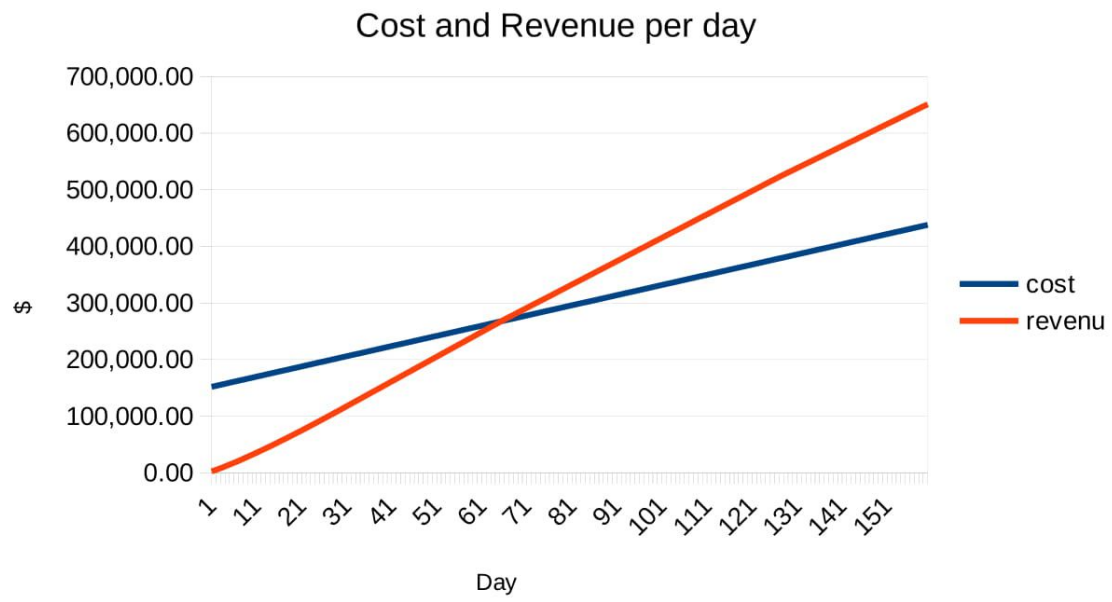
## Q1

98	326,400.00	81.00	7,603.97	402,802.41
99	328,200.00	81.00	7,684.97	406,933.41
100	330,000.00	81.00	7,765.97	411,064.41
101	331,800.00	81.00	7,846.97	415,195.41
102	333,600.00	81.00	7,927.97	419,326.41
103	335,400.00	81.00	8,008.97	423,457.41
104	337,200.00	81.00	8,089.97	427,588.41
105	339,000.00	81.00	8,170.97	431,719.41
106	340,800.00	81.00	8,251.97	435,850.41
107	342,600.00	81.00	8,332.97	439,981.41
108	344,400.00	81.00	8,413.97	444,112.41
109	346,200.00	81.00	8,494.97	448,243.41
110	348,000.00	81.00	8,575.97	452,374.41
111	349,800.00	81.00	8,656.97	456,505.41
112	351,600.00	81.00	8,737.97	460,636.41
113	353,400.00	81.00	8,818.97	464,767.41
114	355,200.00	81.00	8,899.97	468,898.41
115	357,000.00	81.00	8,980.97	473,029.41
116	358,800.00	81.00	9,061.97	477,160.41
117	360,600.00	81.00	9,142.97	481,291.41
118	362,400.00	81.00	9,223.97	485,422.41
119	364,200.00	81.00	9,304.97	489,553.41
120	366,000.00	81.00	9,385.97	493,684.41
121	367,800.00	81.00	9,466.97	497,815.41
122	369,600.00	81.00	9,547.97	501,946.41
123	371,400.00	81.00	9,628.97	506,077.41
124	373,200.00	81.00	9,709.97	510,208.41
125	375,000.00	81.00	9,790.97	514,339.41
126	376,800.00	81.00	9,871.97	518,470.41
127	378,600.00	81.00	9,952.97	522,601.41
128	380,400.00	81.00	10,033.97	526,630.50
129	382,200.00	81.00	10,114.97	530,518.50
130	384,000.00	81.00	10,195.97	534,406.50
131	385,800.00	81.00	10,276.97	538,294.50
132	387,600.00	81.00	10,357.97	542,182.50
133	389,400.00	81.00	10,438.97	546,070.50
134	391,200.00	81.00	10,519.97	549,958.50
135	393,000.00	81.00	10,600.97	553,846.50
136	394,800.00	81.00	10,681.97	557,734.50
137	396,600.00	81.00	10,762.97	561,622.50
138	398,400.00	81.00	10,843.97	565,510.50
139	400,200.00	81.00	10,924.97	569,398.50
140	402,000.00	81.00	11,005.97	573,286.50
141	403,800.00	81.00	11,086.97	577,174.50
142	405,600.00	81.00	11,167.97	581,062.50
143	407,400.00	81.00	11,248.97	584,950.50
144	409,200.00	81.00	11,329.97	588,838.50
145	411,000.00	81.00	11,410.97	592,726.50
146	412,800.00	81.00	11,491.97	596,614.50

Q1

147	414,600.00	81.00	11,572.97	600,502.50
148	416,400.00	81.00	11,653.97	604,390.50
149	418,200.00	81.00	11,734.97	608,278.50
150	420,000.00	81.00	11,815.97	612,166.50
151	421,800.00	81.00	11,896.97	616,054.50
152	423,600.00	81.00	11,977.97	619,942.50
153	425,400.00	81.00	12,058.97	623,830.50
154	427,200.00	81.00	12,139.97	627,718.50
155	429,000.00	81.00	12,220.97	631,606.50
156	430,800.00	81.00	12,301.97	635,494.50
157	432,600.00	81.00	12,382.97	639,382.50
158	434,400.00	81.00	12,463.97	643,270.50
159	436,200.00	81.00	12,544.97	647,158.50
160	438,000.00	81.00	12,625.97	651,046.50

Q1





$$2. \frac{\text{cost}}{\text{gold}} = \frac{\text{cost/day}}{\text{gold/day}} = \frac{(\$150/\text{hr})(12 \text{ hr/d})}{T_N (0.5)(15)(12)/\text{d}} = \frac{\$20/\text{g}}{T_N}$$

$$= \begin{cases} 20/((0.5)N^{0.1728}) = 40N^{-0.1728} & 1 \leq N < 30 \\ 20/(.9) = 22.22 & 30 \leq N \end{cases}$$

Marginal cost depends on which day gold was mined, due to increased efficiency.

3. Varies due to increase efficiency throughout operation, as well as decreased revenue due to increased royalty.

$$T_{30d} = T_{1d} \times N^b$$

$$b = \log_N \left( \frac{T_{30d}}{T_{1d}} \right) = \log_{30} \left( \frac{.9}{.5} \right)$$

$$= .1728$$

← from pt 1

$$\begin{aligned} &\rightarrow \$60 \times .9 && 0 \sim 5000 \text{ g} \\ &\$60 \times .85 && 5000 \sim 10000 \text{ g} \\ &\$60 \times .8 && 10000 \sim \infty \text{ g} \end{aligned}$$

← from Assumption

4. Cost plot stays consistent. Changes happen at revenue:

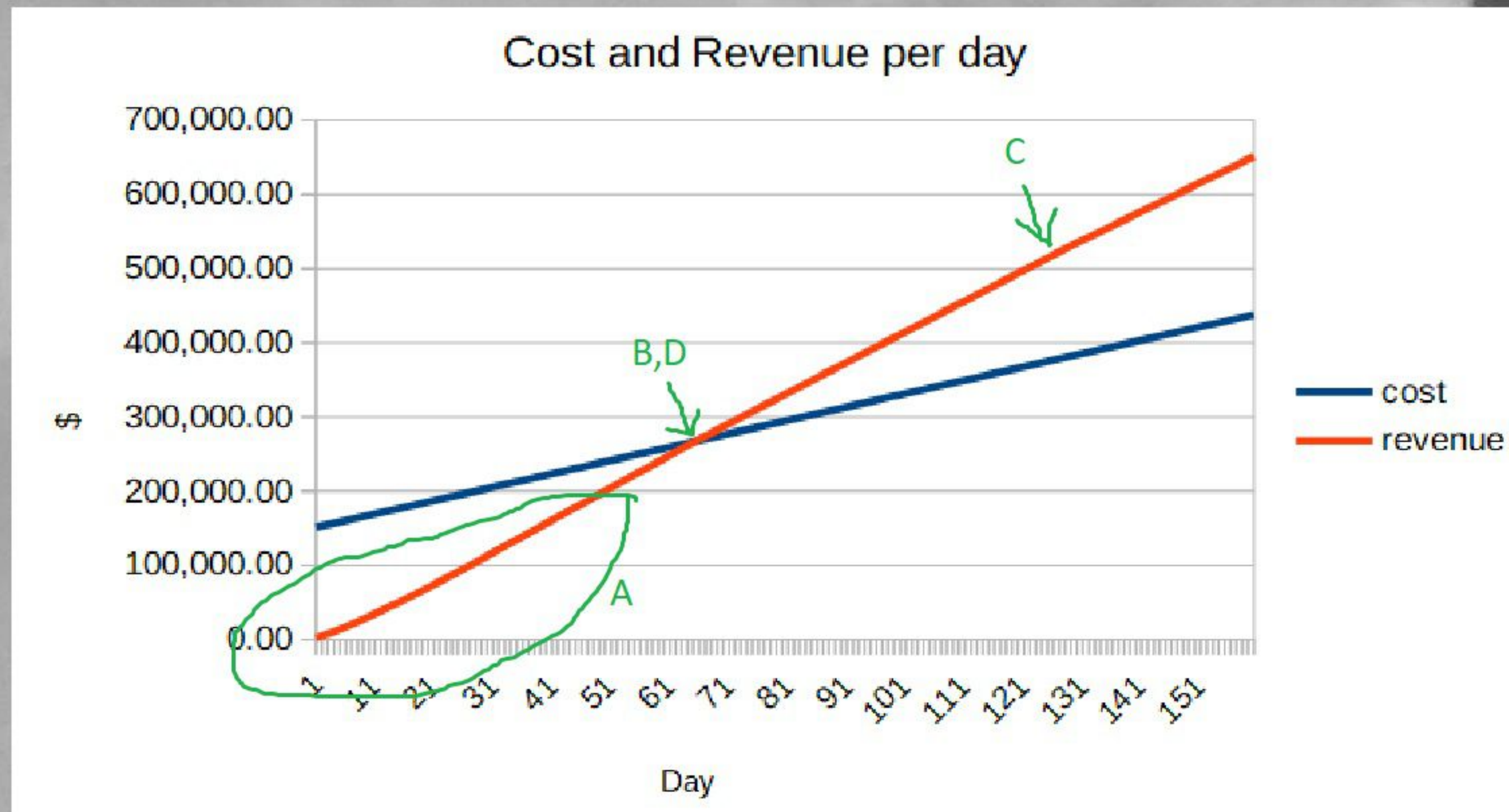
- Initial curve due to increasing efficiency
- Slope slightly less steep due to increased royalty at day 66
- Slope less steep again at day 128
- Break even at day 66

At day 160 =

Cost total = \$438000.00

Rev total = \$651046.50

Profit = \$213046.50





5. She's already at max royalties at current rate.  
As long as her new equipment cost less than  
the increased revenue gained from increased efficiency  
at max revenue, she'll make extra profit.  
That said, it may be less profit per cash invested,  
so she may have other investments that can make  
better use of cash flow.

Q2) Assumption:

- Short time frame (No TVM accounted)
- Include album production cost in tour cash flow
  - ↳ Bands can't tour with just old songs
- Don't include CD sales in tour cash flow

7. 4 main items:

A. Fixed cost = Album production + equipment lease  
 $= -140000$

B. Venue

C. Travel + Setup = Travel  $= 6500$

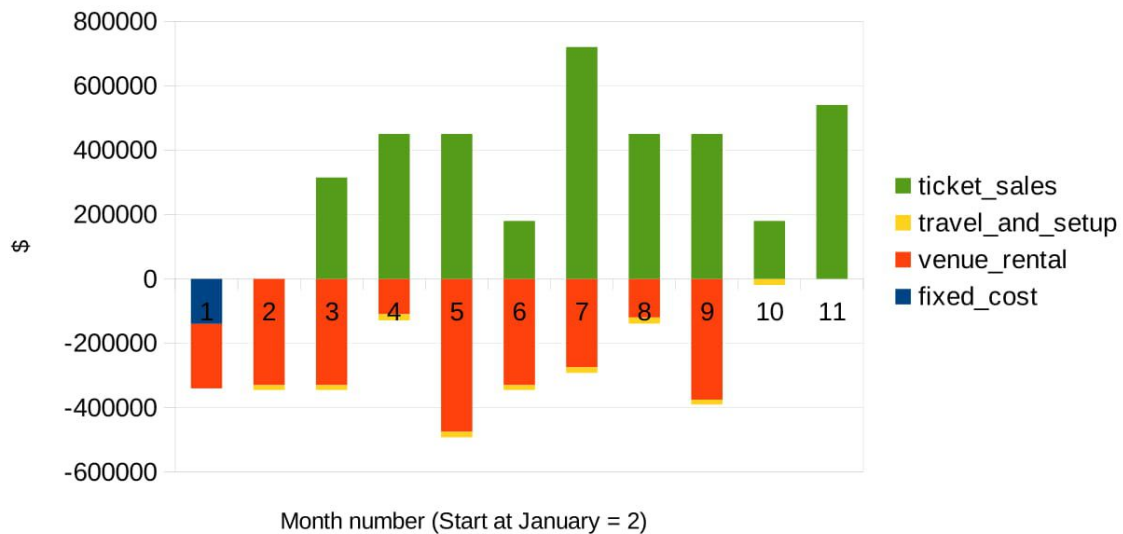
D. Tickets = Seats count  $\times 0.9 \times 50$



## Q2

	Fixed Cost	Venue	Travel+Setup	Ticket sales	Monthly cash flow	Cash flow so far
Before start	-140000	-200000			-340000	-340000
Jan		-330000	-15000		-345000	-685000
Feb		-330000	-15000	315000	-30000	-715000
Mar		-110000	-19000	450000	321000	-394000
Apr		-475000	-17000	450000	-42000	-436000
May		-330000	-15000	180000	-165000	-601000
Jun		-275000	-17000	720000	428000	-173000
Jul		-120000	-19000	450000	311000	138000
Aug		-375000	-15000	450000	60000	198000
Sep			-19000	180000	161000	359000
Oct				540000	540000	899000
Total	-140000	-2545000	-151000	3735000	899000	

Cash flow diagram





# Q2-calculations

Sort by shows	travel	venue	count	venue	travel+setup	tickets
Tacoma	1000	50000	2000	-50000	-7500	90000
Portland	1000	150000	5000	-150000	-7500	225000
SF	1000	150000	5000	-150000	-7500	225000
LA	1000	180000	5000	-180000	-7500	225000
SD	1000	150000	5000	-150000	-7500	225000
Tampa	5000	180000	5000	-180000	-11500	225000
DC	3000	60000	2000	-60000	-9500	90000
Baltimore	1000	50000	2000	-50000	-7500	90000
NYC	1000	250000	8000	-250000	-7500	360000
Philly	1000	225000	8000	-225000	-7500	360000
Boston	1000	180000	5000	-180000	-7500	225000
Chi	3000	150000	5000	-150000	-9500	225000
Denver	3000	150000	5000	-150000	-9500	225000
Phoenix	3000	125000	5000	-125000	-9500	225000
Vegas	1000	70000	2000	-70000	-7500	90000
Houston	1000	50000	2000	-50000	-7500	90000
Austin	1000	50000	2000	-50000	-7500	90000
Seattle	5000	325000	10000	-325000	-11500	450000
Show by month of show	Venue	Travel+Setup	Ticket sales			
Jan	-200000	-15000	315000			
Feb	-330000	-15000	450000			
Mar	-330000	-19000	450000			
Apr	-110000	-17000	180000			
May	-475000	-15000	720000			
Jun	-330000	-17000	450000			
Jul	-275000	-19000	450000			
Aug	-120000	-15000	180000			
Sep	-375000	-19000	540000			



2. Total costs = Fixed + Venue + travel + setup

$$= -140000 - 2545000 - 151000$$

$$= -2836000$$

$$\text{Total Rev} = 3735000$$

$$\text{Total Profit} = 3735000 - 2836000$$

$$= 899000$$

3. Need \$715000 on hands to tour, which is total cost at Feb, when new earning, exceed new spendings.

Become cash positive on July, when all cost are paid.

4. Venue, travel, set-up, and equipment lease renewal would be additional cost to the new show. New show would likely reduce average cost due to album production cost being spread out to more shows, if it'll depend if new show's additional cost exceed current average by a lot or not.

5. Marginal cost = Venue (no set up and travel)

$$= 150000$$

$$\text{Marginal profit if sell out} = 50000 (.9) 50 - 150000$$

$$= 75000$$

$$\text{Break even} \Rightarrow 150000 = n(.9) 50$$

$$n = 3334 \text{ seats sold}$$

Bonus : Smells like Teen spirit