| |
|---|
| Initial cost of equipment |
| Project and equipment life |
| Salvage value of equipment |
| Working capital requirement |
| Depreciation method |
| Depreciation expense |
| Discount rate |
| Tax rate |

| | Base case |
|---|---|
| Unit sales | 10,000 |
| Price per unit | $ 125.00 |
| Variable cost per unit | $ 75.00 |
| Fixed costs | $ 250,000.00 |

Best Case

| | Solution |
|---|---|
| Revenues | $1,512,500 |
| Variable cost | 742,500 |
| Fixed Expenses | 225,000 |
| Gross profit | $545,000 |
| Depreciation | 100,000 |
| Net operating income | $445,000 |
| Income tax expense | 151,300 |
| Net income | $293,700 |
| Cash flow | $393,700 |

| | |
|---|---|
| NPV | |

Expected Case

| | Solution |
|---|---|
| Revenues | $1,250,000 |
| Variable cost | 750,000 |
| Fixed Expenses | 250,000 |
| Gross profit | $250,000 |
| Depreciation | 100,000 |
| Net operating income | $150,000 |
| Income tax expense | 51,000 |
| NOPAT | $99,000 |
| plus: Depreciation | 100,000 |
| less: CAPEX | - |
| less: Working capital investment | - |
| Free cash flow | $199,000 |

| NPV | |
|---|---|

Worst Case — Assuming the negative tax credit

| | Solution |
|---|---|
| Revenues | $1,012,500.00 |
| Variable cost | $742,500.00 |
| Fixed Expenses | $275,000.00 |
| Gross profit | -$5,000.00 |
| Depreciation | $100,000.00 |
| Net operating income | -$105,000.00 |
| Income tax expense | -$35,700.00 |
| Net income | -$69,300.00 |
| Cash flow | $30,700.00 |

| NPV=PV(E12,E7,D50)-E6 | |
|---|---|
| NPV | |

# Problem 3-1

| Given |
|---|
| $1,000,000.00 |
| 10 |
| 0 |
| 0 |
| Straight-Line |
| $100,000.00 |
| 10.00% |
| 34.00% |

| Worst case | Best Case |
|---|---|
| 9000 | 11000 |
| $112.50 | $137.50 |
| $82.50 | $67.50 |
| $275,000.00 | $225,000.00 |

| Excel formula in previous column |
|---|
| F17*F18 |
| F17*F19 |
| F20 |
| D25-D26-D27 |
| E11 |
| D28-D29 |
| D30* E13 |
| D30-D31 |
| D32+D29 |

| |
|---|
| $1,419,116.07 |

| Excel formula |
|---|
| d17*d18 |
| d17*d19 |
| d20 |
| D25-D26-D27 |
| E11 |
| D28-D29 |
| D46* e13 |
| D30-D31 |
| |
| |
| |
| D32+D29 |

| |
|---|
| $222,768.85 |

obtained here can used somewhere else or carried forward

| Excel formula in previous column |
|---|
| E17*E18 |
| E17*E19 |
| E20 |
| D42-D43-D44 |
| E11 |
| D45-D46 |
| D47*E13 |
| D47-D48 |
| D32+D29 |

| |
|---|
| |
| ($811,361.79) |

| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer required |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |

## Problem 3-2

| |
|---|
| Initial cost of equipment |
| Project and equipment life |
| Salvage value of equipment |
| Working capital requirement |
| Depreciation method |
| Depreciation expense |
| Discount rate |
| Tax rate |

| | Base case |
|---|---|
| Unit sales | 11,000 |
| Price per unit | $ 125.00 |
| Variable cost per unit | $ 75.00 |
| Fixed costs | $ 250,000.00 |

**Part a.**

Expected Case

| | Solution |
|---|---|
| Revenues | $1,375,000 |
| Variable cost | 825,000 |
| Fixed Expenses | 250,000 |
| Gross profit | $300,000 |
| Depreciation | 100,000 |
| Net operating income | $200,000 |
| Income tax expense | 68,000 |
| NOPAT | $132,000 |
| plus: Depreciation | 100,000 |
| less: CAPEX | - |
| less: Working capital investment | - |
| Free cash flow | $232,000 |

NPV

**Part b.** Breakeven unit annual sales 8,901

**Part c.** Breakeven unit price (unit sales +15%) $ 113.70

| Given |
|---|
| $1,000,000.00 |
| 10 |
| 0 |
| 0 |
| Straight-Line |
| $100,000.00 |
| 10.00% |
| 34.00% |

| Worst case | Best Case |
|---|---|
| 9900 | |
| $112.50 | $137.50 |
| $82.50 | $67.50 |
| $275,000.00 | $225,000.00 |

| | Excel formula |
|---|---|
| | d17*d18 |
| | d17*d19 |
| | d20 |
| | D25-D26-D27 |
| | E11 |
| | D28-D29 |
| | D46* e13 |
| | D30-D31 |
| | |
| | |
| | |
| | D32+D29 |
| | |
| | $425,539.57 |

| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer required |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |

## Problem 3-3

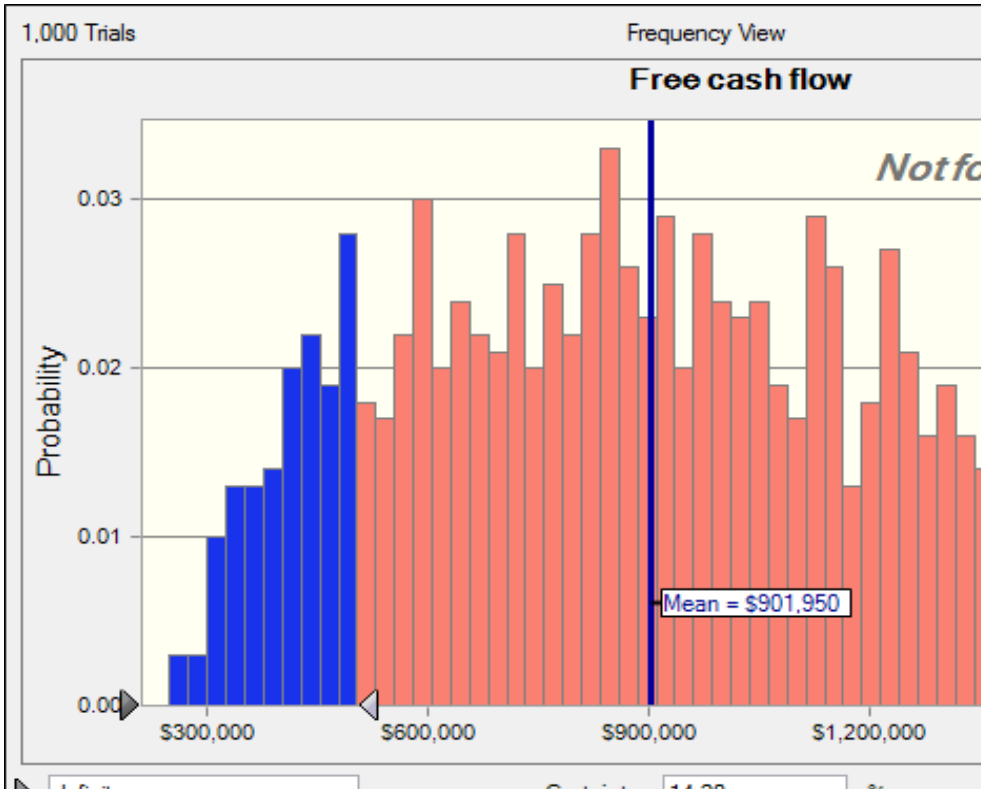
Given:

| | Expected Values | Distributional Assumptions |
|---|---|---|
| Sales units | 100,000 | Uniform |
| Unit price | $ 50 | Normal |
| Fixed operating costs | 120,000 | NA |
| Variable operating costs per unit | 35 | Triangular |
| Tax rate | 30% | NA |
| Depreciation expense | $ 60,000 | NA |
| CAPEX | 75,000 | Uniform |
| Working capital investment | 20,000 | Triangular |

a.

| | |
|---|---|
| Sales | $ 5,000,000 |
| less: Variable operating costs | (3,500,000) |
| less: | (60,000) |
| less: Fixed operating costs | (120,000) |
| Net Operating Profit | $ 1,320,000 |
| less: Taxes | (396,000) |
| NOPAT | $ 924,000 |
| plus: Depreciation expense | 60,000 |
| less: CAPEX | (75,000) |
| less: Working capital investment | (20,000) |
| Free cash flow | $ 889,000 |

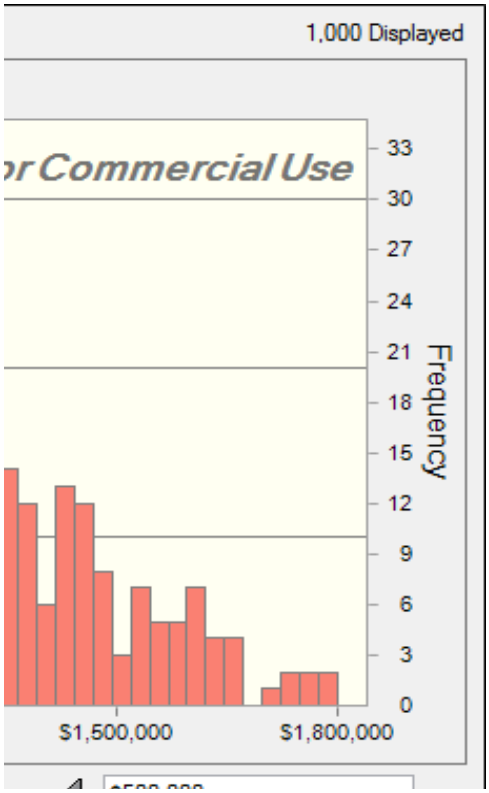
b.




-Infinity
Certainty:
14.20
%

| Parameter Estimates |
| --- |
| max = 150,000;  Min = 50,000 |
| Meam = $50, standard deviation = $10 |
| NA |
| min = $30;most likely = $35; max = $40 |
| NA |
| NA |
| min = $60,000; max = $90,000 |
| min = $18,000; most likely = $20,000; max = $22,000 |

| |
| --- |
| = Value giv |
| = Formula/ |
| = Qualitati |
| = Goal See |
| = Crystal E |
| = Crystal E |




$500,000

## Solution Legend

ven in problem
/Calculation/Analysis required
ve analysis or Short answer required
ek or Solver cell
Ball Input
Ball Output

## **PROBLEM 3-4:** Clayton Manufact

| Given | | | |
|---|---|---|---|
| EBITDA (Year 1) | $ | 200,000 | |
| Growth Rate in EBITDA | | 5% | |
| Initial investment | $ | 800,000 | |
| Depreciation (Straight line) over | | 5 | years |
| Estimated salvage value | $ | - | |
| Tax rate | | 35% | |
| Cost of capital | | 12% | |

**Solution**

| **a.** | **0** | **1** | **2** |
|---|---|---|---|
| EBITDA | | $ 200,000 | $ 210,000 |
| Less: Depreciation Expense | | (160,000) | (160,000) |
| EBIT | | $ 40,000 | $ 50,000 |
| Less: Taxes | | (14,000) | (17,500) |
| NOPAT | | $ 26,000 | $ 32,500 |
| Plus: Depreciation Expense | | 160,000 | 160,000 |
| Less: CAPEX | (800,000) | - | - |
| Less: Change in Working Capital | - | - | - |
| **Project FCF** | **$ (800,000)** | **$ 186,000** | **$ 192,500** |

**b.**

**NPV** $ (85,926)

**c.**

Using "Goal Seek" to solve for the EBITDA in year 1 (C5) that yields a NPV of 0 (C28).

**Breakeven Year 1 EBITDA** $ 233,551

turing Company

| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer required |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |

| Years | 3 | 4 | 5 |
|---|---|---|---|
| | $ 220,500 | $ 231,525 | $ 243,101 |
| | (160,000) | (160,000) | (160,000) |
| | $ 60,500 | $ 71,525 | $ 83,101 |
| | (21,175) | (25,034) | (29,085) |
| | $ 39,325 | $ 46,491 | $ 54,016 |
| | 160,000 | 160,000 | 160,000 |
| | - | - | - |
| | - | - | - |
| | **$ 199,325** | **$ 206,491** | **$ 214,016** |

# **PROBLEM 3-5:** Breakeven Sensitivity

| Given | | |
|---|---|---|
| Investment (enter with "-" sign) | $ (4,000,000) | |
| Plant life | 5 | Years |
| Salvage value | $ 400,000 | |
| Variable Cost % | 45% | |
| Fixed operating cost | $ 1,000,000 | |
| Tax rate | 38% | |
| Working capital | 10% | (Percent of the expected change in revenues for the year) |
| Required Rate of Return | 15% | |
| **Sales volume multiple** | **1.00** | |

| | **0** | **1** | **2** | **Yea** |
|---|---|---|---|---|
| Sales volume | | $ 1,000,000 | $ 1,500,000 | |
| Unit price | | 2.00 | 2.00 | |
| Revenues | | 2,000,000 | 3,000,000 | |
| Variable Operating Costs | | (900,000) | (1,350,000) | |
| Fixed Operating Costs | | (1,000,000) | (1,000,000) | |
| Depreciation Expense | | (800,000) | (800,000) | |
| Net Operating Income | | $ (700,000) | $ (150,000) | |
| Less: Taxes | | 266,000 | 57,000 | |
| NOPAT | | $ (434,000) | $ (93,000) | |
| Plus: Depreciation | | 800,000 | 800,000 | |
| Less: CAPEX | (4,000,000) | - | - | |
| Less: Working Capital | (200,000) | (100,000) | (450,000) | |
| Free Cash Flow | $ (4,200,000) | $ 266,000 | $ 257,000 | |

| | |
|---|---|
| **NPV** | $ 419,435 |
| **IRR** | 18% |
| **Equivalent Annual Cost** | $ 125,124 |

## Solution

**a. What are the key sources of risk that you see in this project?**

The "given" data or parameters capture the variables that are uncertain in the analysis. However, the sensitivity analysis is designed to identify the key sources of uncertainty that are most crucial.

**b. Breakeven sensitivity analysis**

| **Variable** | **Estimated Value** | **Breakeven Value** | **Percent Difference** |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Initial Capex | $ (4,000,000) | $ (4,419,435) | 10% |
| Variable Cost as a % of Sales | 45% | 49% | 9% |
| Working Capital % of new Sales | 10% | 27% | 170% |
| Sales volume multiplier | 1 | 0.92 | -8% |

**c. Discuss results of part b.**

The initial capital cost, variable cost as a percent of sales and the sales volume are all roughly equally important in terms of their significance in driving the results of the investment. The kinds of things that can be done to control these costs entail careful cost contracting for the initial capital cost, and closely monitoring both the variable cost % and sales volume. It would also be helpful to know what "options" the firm might have with regard to reducing output or shutting down should the forecasts of sales volume or variable costs prove to be

**d. Should you always seek to reduce project risk?**

This should provide an interesting discussion since most students are taught that risk is bad. In fact, firms "choose" to assume risks for which they feel particularly well suited to manage. For example, most traditional E&P firms do not attempt to hedge the price risk of their oil and gas reserves but choose to assume this risk as a risk of doing business in an industry where their specialized knowledge and skills make the cost of bearing this risk less than for outsiders that might wish to assume this risk (for a price!).

y Analysis

RENUMBER

| | = Value given in p |
|---|---|
| | = Formula/Calcul |
| | = Qualitative anal |
| | = Goal Seek or So |
| | = Crystal Ball Inp |
| | = Crystal Ball Out |

ar

| 3 | 4 | 5 |
|---|---|---|
| $ 3,000,000 | $ 3,500,000 | $ 2,000,000 |
| 2.50 | 2.50 | 2.50 |
| | | |
| 7,500,000 | 8,750,000 | 5,000,000 |
| (3,375,000) | (3,937,500) | (2,250,000) |
| (1,000,000) | (1,000,000) | (1,000,000) |
| (800,000) | (800,000) | (800,000) |
| $ 2,325,000 | $ 3,012,500 | $ 950,000 |
| (883,500) | (1,144,750) | (361,000) |
| $ 1,441,500 | $ 1,867,750 | $ 589,000 |
| 800,000 | 800,000 | 800,000 |
| - | - | 248,000 |
| (125,000) | 375,000 | 500,000 |
| $ 2,116,500 | $ 3,042,750 | $ 2,137,000 |

| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer required |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |

| Solution Legend |
| --- |
| oroblem |
| ation/Analysis required |
| lysis or Short answer required |
| olver cell |
| ut |
| tput |

## PROBLEM 3-6ab: Bridgeway Pharmaceutic

| Given | | |
|---|---|---|
| Investment cost (today) | $ (400,000) | |
| Project life | 5 | years |
| Depreciation expense | $ 80,000 | |
| Waste disposal cost savings per year | $ 18,000 | |
| Labor cost savings per year | $ 40,000 | |
| Sale of reclaimed waste | $ 200,000 | |
| Required rate of return | 20% | |
| Tax rate | 35% | |

## Solution

**Part a.**

| Cash flow estimation | 0 | 1 | 2 | Y |
|---|---|---|---|---|
| Investment | $ (400,000) | | | |
| Waste disposal cost savings per year | | 18,000 | 18,000 | |
| Labor cost savings per year | | 40,000 | 40,000 | |
| Proceeds from sale of reclaimed waste materials | | 200,000 | 200,000 | |
| EBITDA | | $ 258,000 | $ 258,000 | |
| Less: Depreciation | | (80,000) | (80,000) | |
| Additional EBIT | | $ 178,000 | $ 178,000 | |
| Less: Taxes | | (62,300) | (62,300) | |
| NOPAT | | $ 115,700 | $ 115,700 | |
| Plus: Depreciation | | 80,000 | 80,000 | |
| Less: Capex | | - | - | |
| Less: Additional working capital | | - | - | |
| FCF | $ (400,000) | $ 195,700 | $ 195,700 | |

| | | |
|---|---|---|
| **NPV** | $ 185,263 | |
| **IRR** | 39.74% | |
| **Analysis** | The project appears to be a good one with an expected N | |

**b.**

| | | |
|---|---|---|
| If sale of reclaimed waste drops in half, NPV | $ (9,127) | To answer part **b.** simply subs sale of reclaimed waste in C1 |
| Critical B-E for sale of waste materials | $ 104,695 | |
| Critical B-E Price decline in salvage materials | 47.65% | Solver has been used to find t Details given in text box above |

**c.** See next worksheet

The terminal period growth rates were estimated such that the intrinsic valuation of the firm's equity would equal the current market capitalization of the firm using the "Goal Seek" function.

cals

| |
|---|
| = Value given |
| = Formula/Ca |
| = Qualitative |
| = Goal Seek c |
| = Crystal Ball |
| = Crystal Ball |

| Year 3 | 4 | 5 |
|---|---|---|
| 18,000 | 18,000 | 18,000 |
| 40,000 | 40,000 | 40,000 |
| 200,000 | 200,000 | 200,000 |
| $ 258,000 | $ 258,000 | $ 258,000 |
| (80,000) | (80,000) | (80,000) |
| $ 178,000 | $ 178,000 | $ 178,000 |
| (62,300) | (62,300) | (62,300) |
| $ 115,700 | $ 115,700 | $ 115,700 |
| 80,000 | 80,000 | 80,000 |
| - | - | - |
| - | - | - |
| $ 195,700 | $ 195,700 | $ 195,700 |

NPV of over $185,000.

stitute $100,000 for the
0.

his answer.
e.

| Solution Legend |
| --- |
| ı in problem |
| ılculation/Analysis required |
| analysis or Short answer required |
| or Solver cell |
| l Input |
| l Output |

## PROBLEM 3-6c: Bridgeway

| Given | | |
|---|---|---|
| Investment cost (today) | $ (400,000) | |
| Project life | 5 | years |
| Depreciation expense | $ 80,000 | |
| Waste disposal cost savings per year | $ 18,000 | |
| Labor cost savings per year | $ 40,000 | |
| Sale of reclaimed waste | $ 200,000 | |
| Required rate of return | 20% | |
| Tax rate | 35% | |
| Correlation (Year to year) in Proceeds from reclaimed waste | 0.90 | |

## Solution

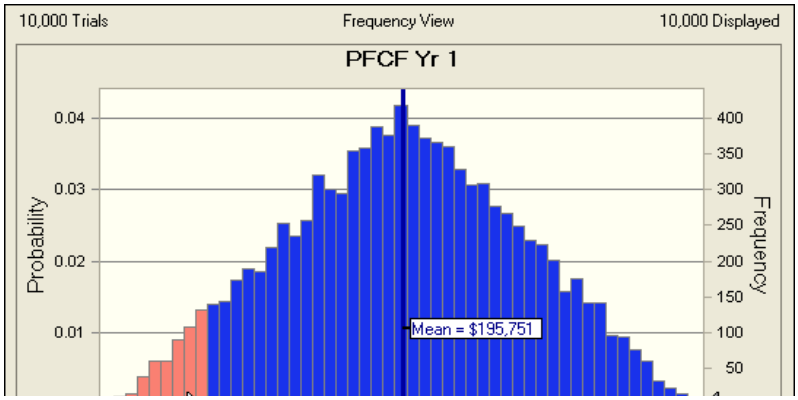
**c.**

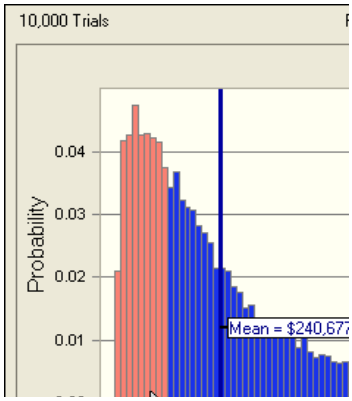
| **Cash flow estimation** | **0** | **1** |
|---|---|---|
| Investment | $ (400,000) | |
| Waste disposal cost savings per year | | $ 18,000 |
| Labor cost savings per year | | 40,000 |
| Proceeds from sale of reclaimed waste | | 200,000 |
| EBITDA | | $ 258,000 |
| Less: Depreciation | | (80,000) |
| Additional EBIT | | $ 178,000 |
| Less: Taxes | | (62,300) |
| NOPAT | | $ 115,700 |
| Plus: Depreciation | | 80,000 |
| Less: Capex | | - |
| Less: Additional working capital | | - |
| FCF | (400,000) | $ 195,700 |

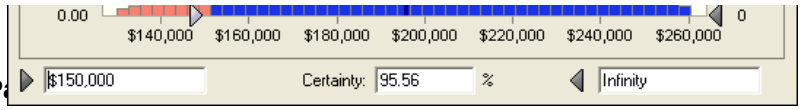
| | |
|---|---|
| **NPV** | $ 185,263 |
| **IRR** | 39.74% |

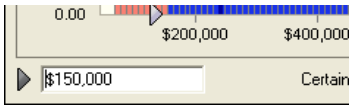
**Note:** Your res
here where yo
fact, if you do
slightly from o
Preferences/S

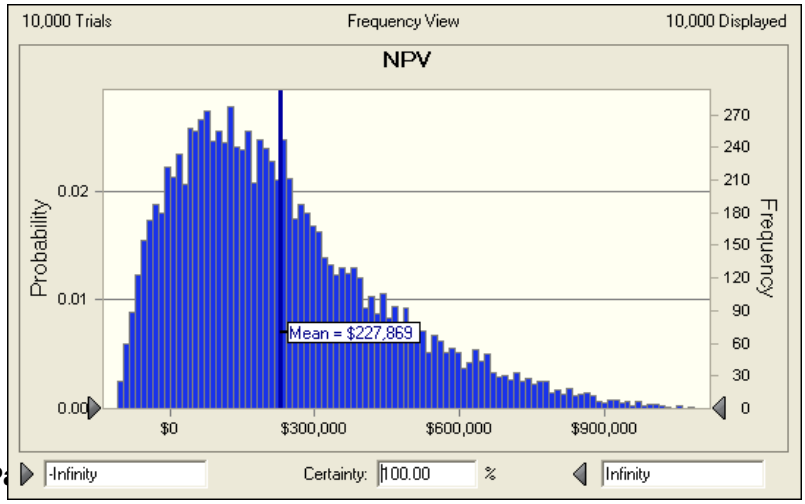
**Part i.**

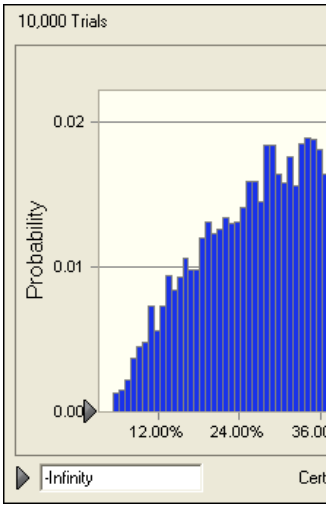


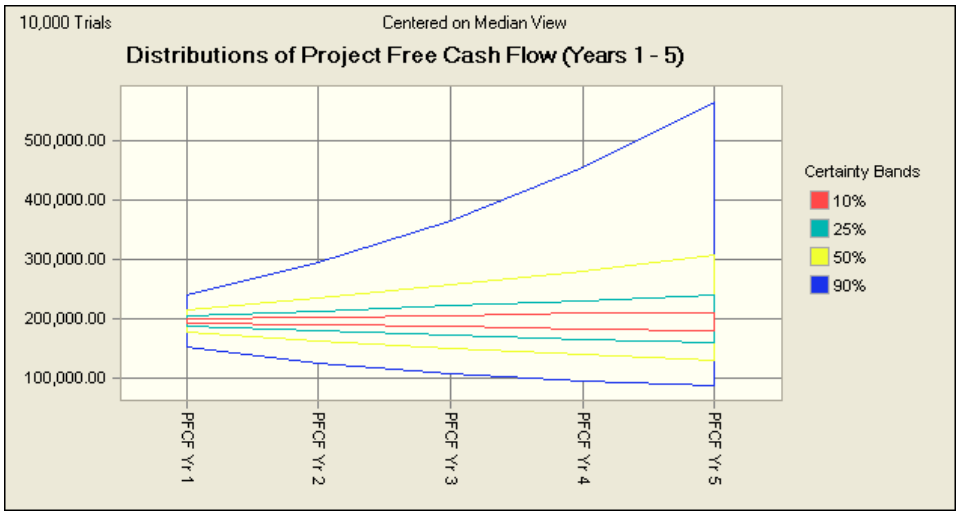




0.00
$140,000
$160,000
$180,000
$200,000
$220,000
$240,000
$260,000
0
$150,000
Certainty: 95.56 %
Infinity


0.00
$200,000
$400,000
$150,000


10,000 Trials
Frequency View
10,000 Displayed
NPV
Probability
Frequency
0.02
0.01
0.00
270
240
210
180
150
120
90
60
30
0
Mean = $227,869
$0
$300,000
$600,000
$900,000
-Infinity
Certainty: 100.00 %
Infinity


10,000 Trials
Probability
0.02
0.01
0.00
12.00%
24.00%
-Infinity

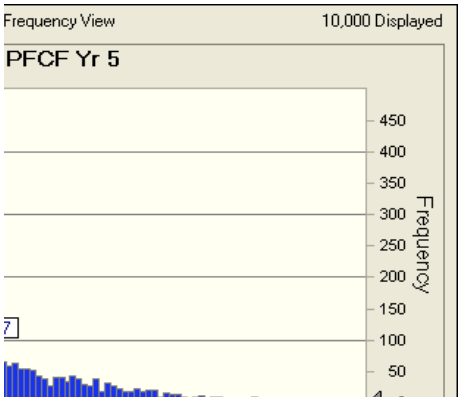

10,000 Trials
Centered on Median View
Distributions of Project Free Cash Flow (Years 1 - 5)
500,000.00
400,000.00
300,000.00
200,000.00
100,000.00
PFCF Yr 1
PFCF Yr 2
PFCF Yr 3
PFCF Yr 4
PFCF Yr 5
Certainty Bands
10%
25%
50%
90%

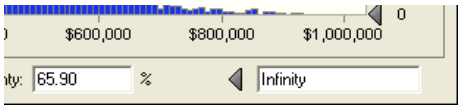
# Pharmaceuticals

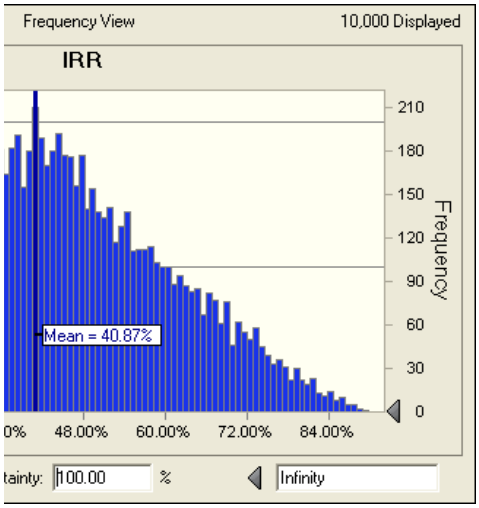
| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer required |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |

| | Year | | | |
|---|---|---|---|---|
| | 2 | 3 | 4 | 5 |
| | $ 18,000 | $ 18,000 | $ 18,000 | $ 18,000 |
| | 40,000 | 40,000 | 40,000 | 40,000 |
| | 200,000 | 200,000 | 200,000 | 200,000 |
| | $ 258,000 | $ 258,000 | $ 258,000 | $ 258,000 |
| | (80,000) | (80,000) | (80,000) | (80,000) |
| | $ 178,000 | $ 178,000 | $ 178,000 | $ 178,000 |
| | (62,300) | (62,300) | (62,300) | (62,300) |
| | $ 115,700 | $ 115,700 | $ 115,700 | $ 115,700 |
| | 80,000 | 80,000 | 80,000 | 80,000 |
| | - | - | - | - |
| | - | - | - | - |
| | $ 195,700 | $ 195,700 | $ 195,700 | $ 195,700 |

sults from the simulation experiment will differ slightly from those reported
u did not use the same "seed" value for the random number generator. In
not "fix" the same seed value for each simulation your results will differ
ne simulation of the same problem to another (see Run
ampling).




0
$600,000
$800,000
$1,000,000
65.90
%
Infinity


Frequency View
10,000 Displayed
IRR
210
180
150
120
90
60
30
0
Frequency
Mean = 40.87%
0%
48.00%
60.00%
72.00%
84.00%
100.00
%
Infinity

## PROBLEM 3-4: TitMar M

### Given

| Assumptions and Predictions | Estimates | |
|---|---|---|
| Price per unit | **$ 4,895** | |
| Market share (%) | **15.00%** | |
| Market size (Year 1) | $ 200,000 | units |
| Growth rate in market size beginning in Year 2 | 5.00% | |
| Unit variable cost | $ 4,250 | |
| Fixed cost | $ 9,000,000 | |
| Tax rate | 50.00% | |
| Cost of capital | 18.00% | |
| Investment in NWC | 5.00% | of the predicted change in firm revenues. |
| Initial investment in PP&E | $ 7,000,000 | |
| Depreciation (5 year life w/no salvage) | $ 1,400,000 | |

### Solution

| | 0 | 1 |
|---|---|---|
| Investment | $ (7,000,000) | |
| Revenue | | 146,850,000 |
| Variable Cost | | (127,500,000) |
| Fixed cost | | (9,000,000) |
| Depreciation | | (1,400,000) |
| EBT(Net Operating Income) | | $ 8,950,000 |
| Tax | | (4,475,000) |
| Net Operating Profit after Tax (NOPAT) | | $ 4,475,000 |
| Plus: Depreciation expense | | 1,400,000 |
| Less: Capex | (7,000,000) | - |
| Less: Change in NWC | (7,342,500) | (367,125) |
| Free Cash Flow | $ (14,342,500) | $ 5,507,875 |
| | | |
| **Net Present Value** | $ 9,526,209 | |
| **Internal Rate of Return** | 39.82% | |
| | | |
| Units Sold | | 30,000 |

**a. If the market share is only 5% then the project's NPV =**
**b. If market share = 15% and the price of the PTV falls to $4,500 the NPV =**

| Breakeven Sensitivity Analysis | Critical % Change | Critical Value |
|---|---|---|
| **Price per unit** | **-3.88%** | **$ 4,705** |
| Market share (%) | -33.53% | 9.97% |
| Market size (Year 1) | -33.53% | $ 132,936 |
| Growth rate in market size beginning in Year 2 | -496.00% | -19.80% |
| **Unit variable cost** | **4.40%** | **$ 4,437** |

| | | | |
|---|---|---|---|
| Fixed cost | 67.69% | $ | 15,092,541 |
| Tax rate | 57.20% | | 78.60% |
| Cost of capital | 121.22% | | 39.82% |
| Investment in NWC | 212.00% | | 15.60% |
| | | | |
| **Analysis:** | The above analysis suggests that the two k | | |

otor Company

**Part b.** Substitute $4,500 for the price per unit.
**Part a.** Substitute 5% for market share (%) .

| | Year 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| | 154,192,500 | 161,902,125 | 169,997,231 | 178,497,093 |
| | (133,875,000) | (140,568,750) | (147,597,188) | (154,977,047) |
| | (9,000,000) | (9,000,000) | (9,000,000) | (9,000,000) |
| | (1,400,000) | (1,400,000) | (1,400,000) | (1,400,000) |
| $ | 9,917,500 | $ 10,933,375 | $ 12,000,044 | $ 13,120,046 |
| | (4,958,750) | (5,466,688) | (6,000,022) | (6,560,023) |
| $ | 4,958,750 | $ 5,466,688 | $ 6,000,022 | $ 6,560,023 |
| | 1,400,000 | 1,400,000 | 1,400,000 | 1,400,000 |
| | - | - | - | - |
| | (385,481) | (404,755) | (424,993) | 8,924,855 |
| $ | 5,973,269 | $ 6,461,932 | $ 6,975,029 | $ 16,884,878 |
| | 31,500 | 33,075 | 34,729 | 36,465 |

| | |
|---|---|
| $ | (9,413,430) |
| $ | (10,261,801) |

ey value drivers are price per unit and unit variable cost!

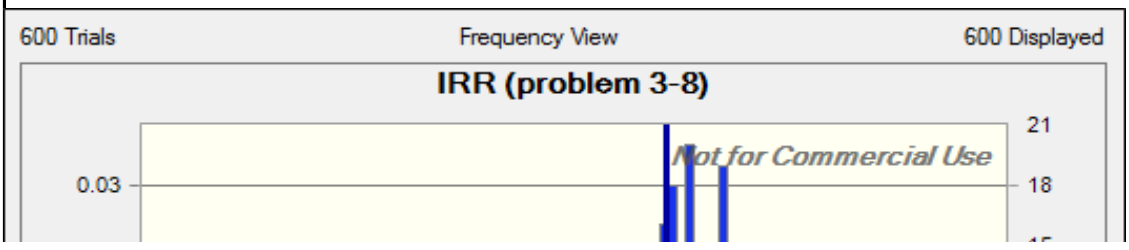
| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer required |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |

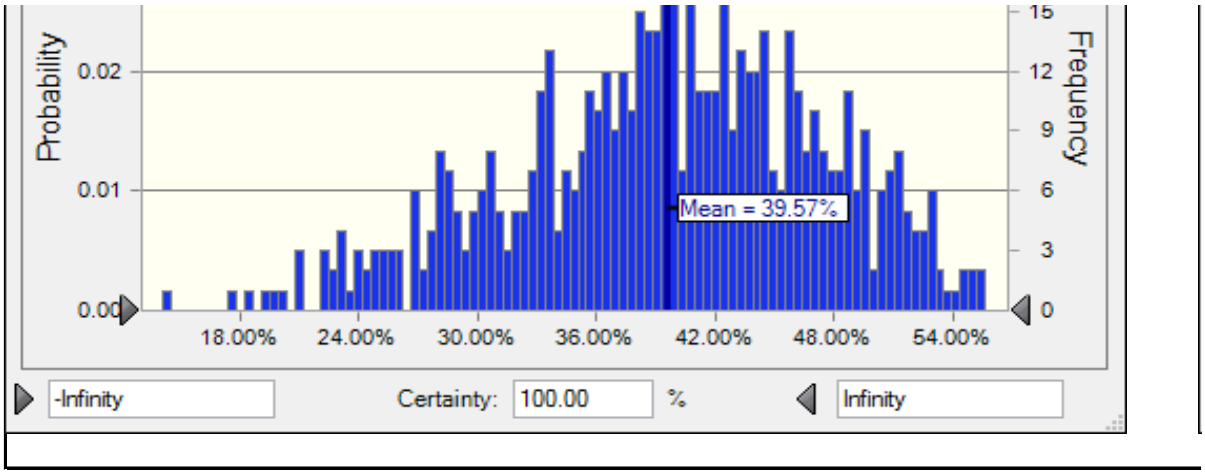
## PROBLEM 3

| Given | | | |
|---|---|---|---|
| **Assumptions and Predictions** | | **Estimates** | |
| Price per unit | $ | 4,895 | |
| Market share (%) | | 15.00% | |
| Market size (Year 1) | | 200,000 | |
| Growth rate in market size beginning in Year 2 | | 5.00% | |
| Unit variable cost | $ | 4,250 | |
| Fixed cost | $ | 9,000,000 | |
| Tax rate | | 50.0% | |
| Cost of capital | | 18.00% | |
| Investment in NWC | | 5.00% | of the predicted change in firm revenues. |
| Initial investment in pp&e | $ | 7,000,000 | |
| Depreciation (5 year life w/no salvage) | $ | 1,400,000 | |

| | | 0 | | 1 |
|---|---|---|---|---|
| Investment | $ | (7,000,000) | | - |
| Growth rate in market size | | | | 5.0% |
| Market Size (total PTV sold) | | | | 200,000 |
| Market Share (units sold by Titmar) | | | | 30,000 |
| Revenue | | | | 146,850,000 |
| Variable Cost | | | | (127,500,000) |
| Fixed cost | | | | (9,000,000) |
| Depreciation | | | | (1,400,000) |
| EBT(Net Operating Income) | | | $ | 8,950,000 |
| Tax | | | | (4,475,000) |
| Net Operating Profit after Tax (NOPAT) | | | $ | 4,475,000 |
| Plus: Depreciation expense | | | | 1,400,000 |
| Less: Capex | | (7,000,000) | | - |
| Less: Change in NWC | | (7,342,500) | | (367,125) |
| Free Cash Flow | $ | (14,342,500) | $ | 5,507,875 |

| | | |
|---|---|---|
| **Net Present Value** | $ | 9,526,209 |
| **Internal Rate of Return** | | 39.82% |



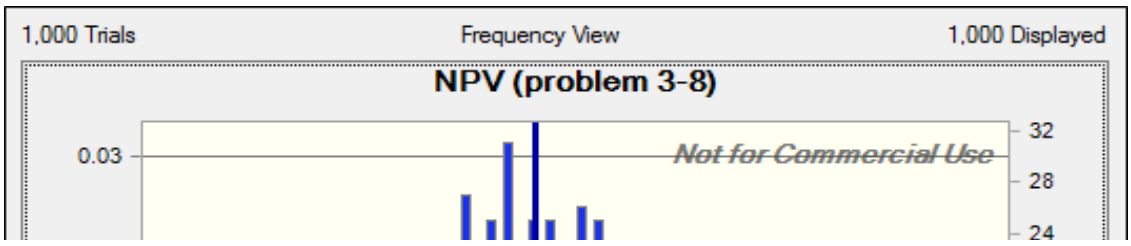

Probability
0.02
0.01
0.00
Frequency
15
12
9
6
3
0
Mean = 39.57%
18.00%
24.00%
30.00%
36.00%
42.00%
48.00%
54.00%
-Infinity
Certainty:
100.00
%
Infinity

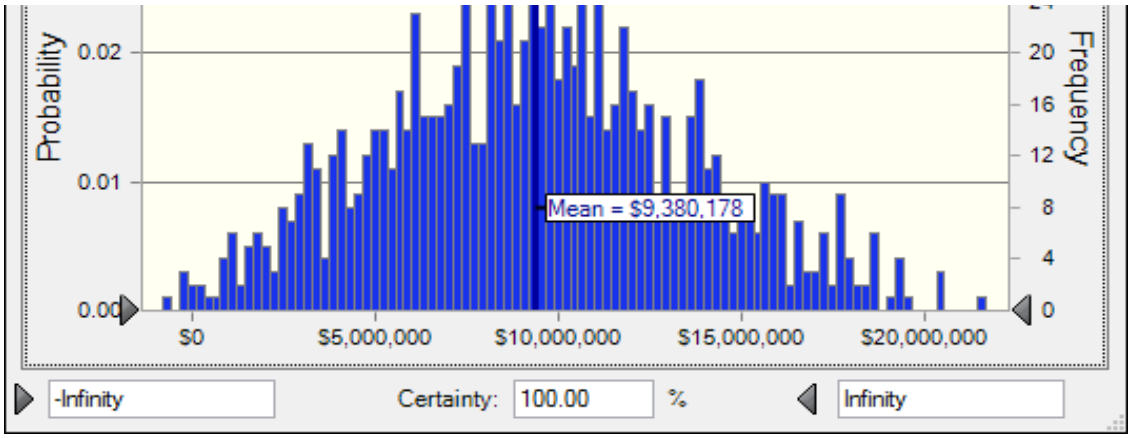
## **-8:** TitMar Motor Company

| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer required |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |

## Solution

| Year | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| | - | - | - | - |
| | 5.0% | 5.0% | 5.0% | 5.0% |
| | 210,000 | 220,500 | 231,525 | 243,101 |
| | 31,500 | 33,075 | 34,729 | 36,465 |
| | 154,192,500 | 161,902,125 | 169,997,231 | 178,497,093 |
| | (133,875,000) | (140,568,750) | (147,597,188) | (154,977,047) |
| | (9,000,000) | (9,000,000) | (9,000,000) | (9,000,000) |
| | (1,400,000) | (1,400,000) | (1,400,000) | (1,400,000) |
| | $ 9,917,500 | $ 10,933,375 | $ 12,000,044 | $ 13,120,046 |
| | (4,958,750) | (5,466,688) | (6,000,022) | (6,560,023) |
| | $ 4,958,750 | $ 5,466,688 | $ 6,000,022 | $ 6,560,023 |
| | 1,400,000 | 1,400,000 | 1,400,000 | 1,400,000 |
| | - | - | - | - |
| | (385,481) | (404,755) | (424,993) | 8,924,855 |
| | $ 5,973,269 | $ 6,461,932 | $ 6,975,029 | $ 16,884,878 |




Probability
0.02
0.01
0.00
Frequency
20
16
12
8
4
0
Mean = $9,380,178
$0
$5,000,000
$10,000,000
$15,000,000
$20,000,000
-Infinity
Certainty:
100.00
%
Infinity

## **PROBLEM 3-9:** Earthilizer Problem--Decision Tree

| Given | | |
|---|---|---|
| EPA after-tax cost | $ | 80,000 |
| Abandonment Value | **$** | **350,000** |
| Probability of Good EPA Ruling | | 80% |

### Solution

**Panel a. No Option to Abandon**

| | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|
| Favorable EPA Ruling--Expected Project FCFs | $ (580,000) | $ 87,600 | $ 78,420 | $ 93,320 |
| NPV (Favorable EPA Ruling) = | $ 43,062 | | | |
| | | | | |
| Unfavorable EPA Ruling--Expected FCFs | $ (580,000) | $ 7,600 | $ (1,580) | $ 13,320 |
| NPV (Unfavorable EPA Ruling) | $ (236,608) | | | |
| | | | | |
| Revised Expected Project FCFs | $ (580,000) | $ 71,600 | $ 62,420 | $ 77,320 |
| E[NPV] with No Option to Abandon | $ (12,872) | | | |

**Panel b. Option to Abandon**

| | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|
| Project Not Abandoned (Favorable EPA) | $ (580,000) | $ 87,600 | $ 78,420 | $ 93,320 |
| NPV (Favorable EPA Ruling) = | $ 43,062 | | | |
| | | | | |
| Project Abandoned (Unfavorable EPA) | $ (580,000) | $ 437,600 | $ - | $ - |
| NPV (Unfavorable EPA Ruling) | $ (193,598) | | | |
| | | | | |
| Revised Expected Project FCFs | $ (580,000) | $ 157,600 | $ 62,736 | $ 74,656 |
| **E[NPV] with the Option to Abandon** | **$ (4,270)** | | | |

**Analysis:**

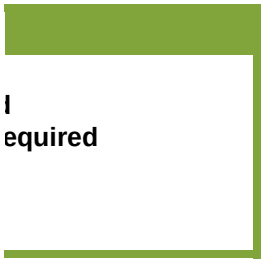
Reducing the abandonment value to $350,000 reduces the
with the abandonment option to $(4,270). The break-even a
makes the expected NPV of the proposed investment zero

| | 2011 | 2012 |
|---|---|---|
| | $ 109,710 | $ 658,770 |
| | $ 29,710 | $ 578,770 |
| | $ 93,710 | $ 642,770 |

| | 2011 | 2012 |
|---|---|---|
| | $ 109,710 | $ 658,770 |
| | $ - | $ - |
| | $ 87,768 | $ 527,016 |

expected NPV of the project
abandonment value that
is $374,177.

| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer r |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |


l
equired

## **PROBLEM 3-10:** Introductory Simulation Analysis Exercises

**a. Jason Enterprises**

| Given | | |
|---|---|---|
| Gross Profit/Sales | | 25% |
| Sales (upper limit) | $ | 10,000,000 |
| Sales (lower limit) | $ | 7,000,000 |

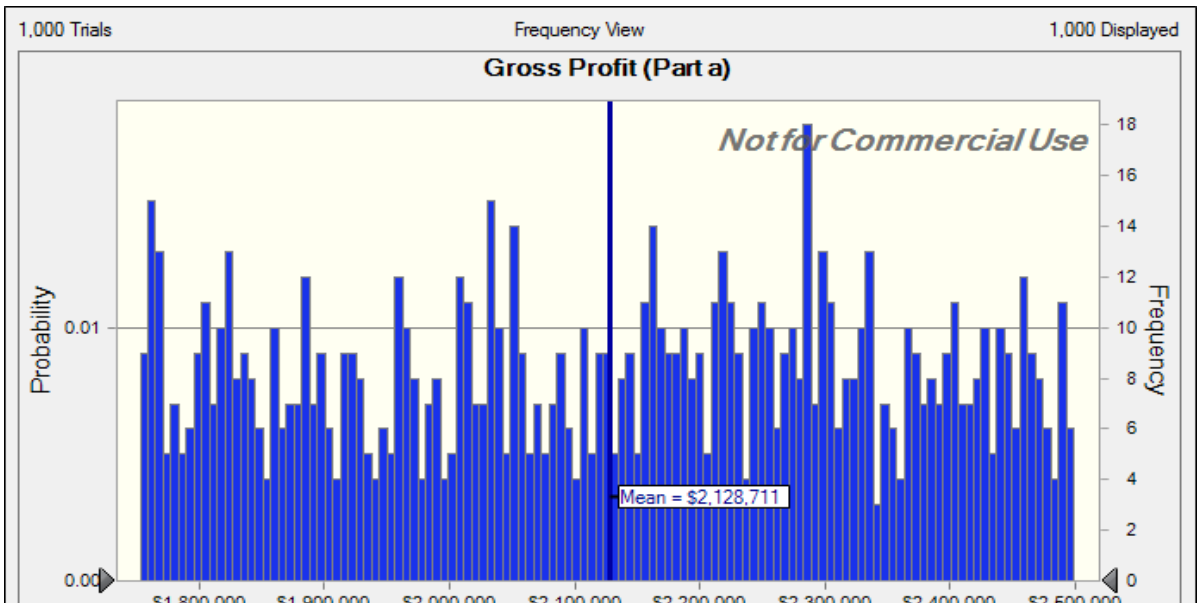
| Solution | | |
|---|---|---|
| Forecasted Sales | $ | 8,500,000 |
| Gross profits | $ | 2,125,000 |

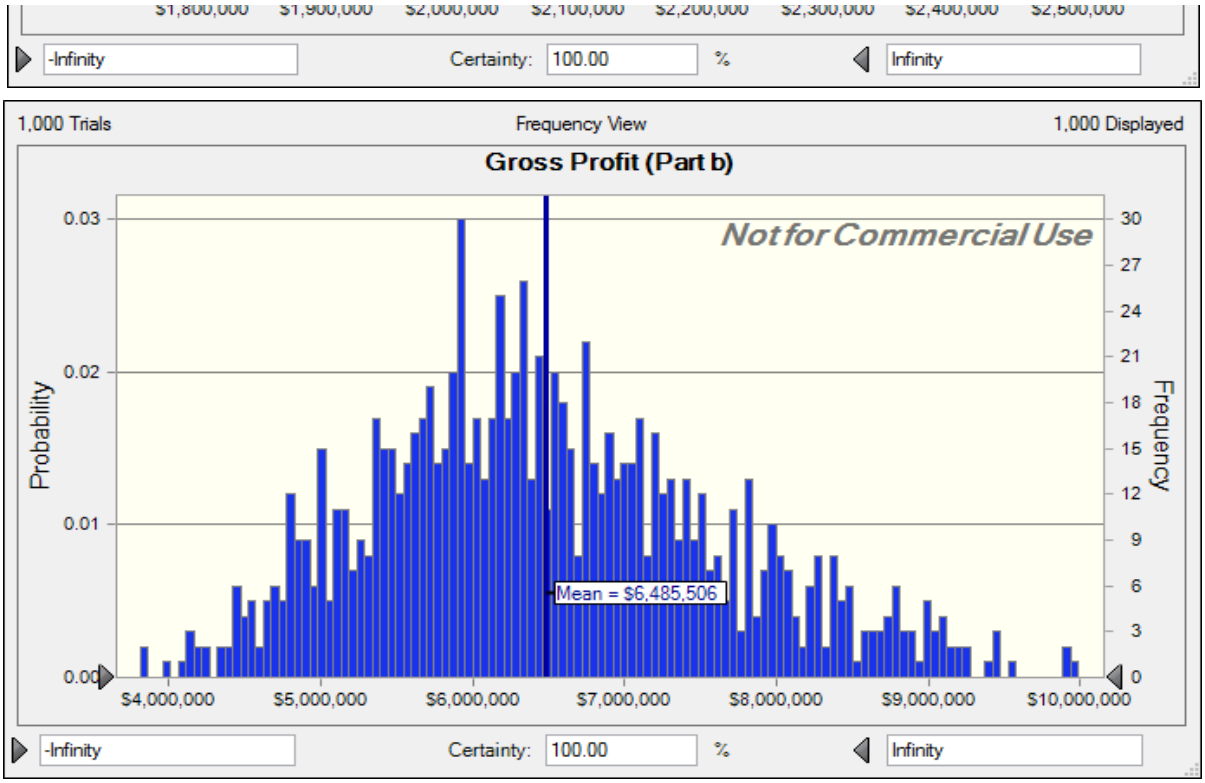
| | |
|---|---|
| | = Value given |
| | = Formula/Cal |
| | = Qualitative a |
| | = Goal Seek o |
| | = Crystal Ball |
| | = Crystal Ball |

**b. Aggiebear Dog Snacks, Inc.**

| Given | | | |
|---|---|---|---|
| Revenues | Minimum | $ | 18,000,000 |
| | Most likely | $ | 25,000,000 |
| | Maximum | $ | 35,000,000 |
| Cost of Goods sold/Revenues | Minimum | | 70% |
| | Maximum | | 80% |

| Solution | | |
|---|---|---|
| Forecasted Sales | $ | 26,000,000 |
| Cost of Goods Sold/Sales | | 0.75 |
| | | |
| **Part i-iii.** | | |
| Sales | $ | 26,000,000 |
| Less: Cost of Goods Sold | | (19,500,000) |
| Gross Profit | $ | 6,500,000 |




$1,800,000
$1,900,000
$2,000,000
$2,100,000
$2,200,000
$2,300,000
$2,400,000
$2,500,000
-Infinity
Certainty:
100.00
%
Infinity
1,000 Trials
Frequency View
1,000 Displayed
Gross Profit (Part b)
Not for Commercial Use
Probability
Frequency
0.03
0.02
0.01
0.00
30
27
24
21
18
15
12
9
6
3
0
Mean = $6,485,506
$4,000,000
$5,000,000
$6,000,000
$7,000,000
$8,000,000
$9,000,000
$10,000,000
-Infinity
Certainty:
100.00
%
Infinity

## Solution Legend

in problem
culation/Analysis required
nalysis or Short answer required
r Solver cell

Input
Output

## PROBLEM 3-11: Rayner Aeronautics

| Given | | |
|---|---|---|
| Investment Outlay (Year 0) | $ | 12,500,000 |
| Year 1 Expected Cash Flow | $ | 2,000,000 |
| Required Rate of Return | | 18% |

| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer required |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |

### Solution

**a.**

**Break-Even Growth Rate in Cash flows** **41.06%**

| Year | Growth Rate | Cash Flows | | |
|---|---|---|---|---|
| 0 | | $ (12,500,000) | NPV = | (0.00) |
| 1 | 0 | 2,000,000 | | |
| 2 | 41.06% | 2,821,214 | | |
| 3 | 41.06% | 3,979,623 | | |
| 4 | 41.06% | 5,613,683 | | |
| 5 | 41.06% | 7,918,699 | | |

**b.**

**Simulation Model**

| | Variable | | Mean | Std. Deviation |
|---|---|---|---|---|
| **Year 1 cash flow** | $ 2,000,000 | **Normal distribution** | $ 2,000,000 | $ 1,000,000 |

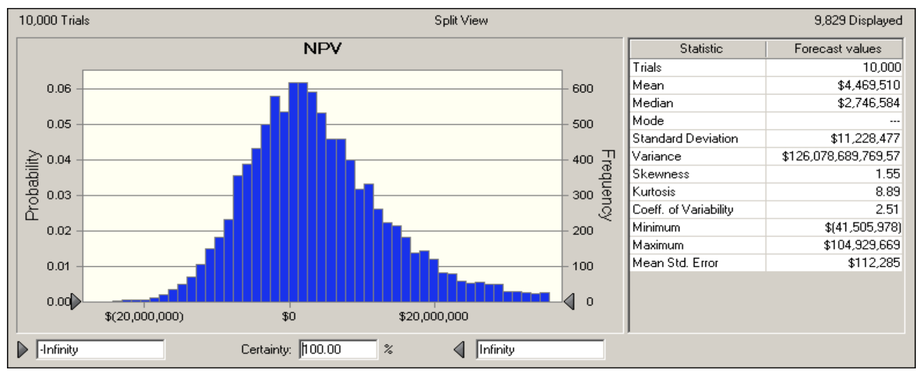
| **Annual Growth Rates** | | **Triangular Distrbution** | | |
|---|---|---|---|---|
| **Year** | | **Most likely** | **Minimum** | **Maximum** |
| 2 | 46.67% | 40.00% | 20.00% | 80.00% |
| 3 | 54.44% | 40.00% | 10.00% | 160.00% |
| 4 | 63.52% | 40.00% | 5.00% | 320.00% |
| 5 | 74.10% | 40.00% | 2.50% | 640.00% |

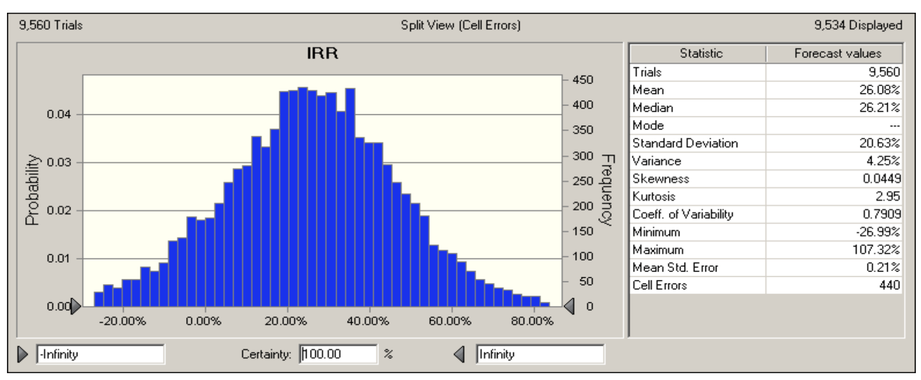
| Year | Growth Rate | Cash Flows |
|---|---|---|
| 0 | | $ (12,500,000) |
| 1 | 0 | 2,000,000 |
| 2 | 46.67% | 2,933,333 |
| 3 | 54.44% | 4,530,370 |
| 4 | 63.52% | 7,407,995 |
| 5 | 74.10% | 12,897,684 |

**c.**

**Results of Simulation**

| | | |
|---|---|---|
| NPV | $ | 3,517,571 |
| IRR | | 26.58% |
| Expected NPV | $ | 4,469,510 see mean value in chart below |
| Expected IRR | | 26.08% see mean value in chart below |



## PROBLEM 3-12: Con

| Given | |
|---|---|
| ConocoPhillips's Cost of Capital for project | 15.00% |
| Project life | 10 years |

**1.**

| | 0 | 1 | 2 |
|---|---|---|---|
| Investment | $ 1,200,000 | | |
| Increase in NWC | 145,000 | | |
| MACRS Depr Rate (7 year) | | 0.1429 | 0.2449 |
| Natural Gas Wellhead Price (per MCF) | | 6 | 6 |
| Volume (MCF/day) | | 900 | 720 |
| Days per year | | 365 | |
| Fee to Producer of Natural Gas | | $3.00 | $3.00 |
| Compression & processing costs (per MCF) | | 0.65 | 0.65 |
| **Cash Flow Calculations** | | | |
| Natural Gas Wellhead Price Revenue | | $ 1,971,000 | $ 1,576,800 |
| Lease fee expense | | 985,500 | 788,400 |
| Compression & processing costs | | 213,525 | 170,820 |
| Depreciation expense | | 171,480 | 293,880 |
| Net operating Profit | | $ 600,495 | $ 323,700 |
| Less: Taxes (40%) | | (240,198) | (129,480) |
| Net operating profit after tax (NOPAT) | | $ 360,297 | $ 194,220 |
| Plus: Depreciation expense | | 171,480 | 293,880 |
| Return of net working capital | | | |
| Project Free Cash Flow | $ (1,345,000) | $ 531,777 | $ 488,100 |
| **NPV** | $ 280,051 | | |
| **IRR** | 22.43% | | |

**2a-c.** Scenario Summary

| | Current Values | Best Case | Most Likely Case |
|---|---|---|---|
| **Changing Cells** | | | |
| NG Price | 6 | 8 | 6 |
| Production Rate | 900 | 1200 | 900 |
| **Result Cells** | | | |
| NPV | $ 280,051 | $ 1,440,400 | $ 280,051 |
| IRR | 22.43% | 53.11% | 22.43% |

**Notes:** Current Values column represents values of changing cells at time Scenario Summary Repor

**3.** Breakeven Sensitivity Analsyis

Students should use Goal Seek in Excel to answer this question.

**a.**

| | |
|---|---|
| Breakeven nautral gas price for an NPV = 0 | $ 4.98 |

**b.**

| | |
|---|---|
| Breakeven natural gas volume in Year 1 for an NPV = 0 | 704 |

**c.**

| | |
|---|---|
| Breakeven investment for an NPV = 0 | $ 1,573,795 |

**4.** Student answers will vary but most will probably recommend the project.

The problem is intentionally set up to illustrate the risk of natural gas prices because the price is very
suggest students go to the internet and look at current natural gas prices. A good website to suggest
http://www.wtrg.com. On November 29, 2007, the NYMEX price for natural gas was $7.56. At higher
prices, this project is very profitable. However, in subsequent years the price fell to below $3.00.

# ocoPhillips Natural Gas Wellhead Project

## Solution

| | Years | | | | | | |
|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | 0.1749 | 0.1249 | 0.0893 | 0.0893 | 0.0893 | 0.0445 | |
| | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | 576 | 461 | 369 | 295 | 236 | 189 | 151 |
| | | | | | | | |
| | $3.00 | $3.00 | $3.00 | $3.00 | $3.00 | $3.00 | $3.00 |
| | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| | $ 1,261,440 | $ 1,009,152 | $ 807,322 | $ 645,857 | $ 516,686 | $ 413,349 | $ 330,679 |
| | 630,720 | 504,576 | 403,661 | 322,929 | 258,343 | 206,674 | 165,339 |
| | 136,656 | 109,325 | 87,460 | 69,968 | 55,974 | 44,779 | 35,824 |
| | 209,880 | 149,880 | 107,160 | 107,160 | 107,160 | 53,400 | - |
| | $ 284,184 | $ 245,371 | $ 209,041 | $ 145,801 | $ 95,209 | $ 108,495 | $ 129,516 |
| | (113,674) | (98,148) | (83,616) | (58,320) | (38,083) | (43,398) | (51,806) |
| | $ 170,510 | $ 147,223 | $ 125,425 | $ 87,480 | $ 57,125 | $ 65,097 | $ 77,710 |
| | 209,880 | 149,880 | 107,160 | 107,160 | 107,160 | 53,400 | - |
| | $ 380,390 | $ 297,103 | $ 232,585 | $ 194,640 | $ 164,285 | $ 118,497 | $ 77,710 |

## Worst Case

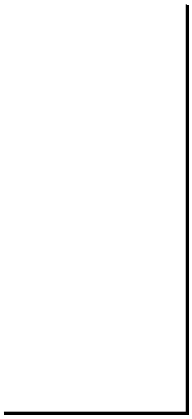
| |
|---|
| 3 |
| 700 |
| $ (645,791) |
| -2.34% |

t was created.

volatile. We
is
natural gas

| 10 |
|---|
| |
| |
| 6 |
| 121 |
| |
| $3.00 |
| 0.65 |
| |
| $ 264,543 |
| 132,272 |
| 28,659 |
| - |
| $ 103,613 |
| (41,445) |
| $ 62,168 |
| - |
| 145,000 |
| $ 207,168 |

| Solution Legend | |
|---|---|
| | = Value given in problem |
| | = Formula/Calculation/Analysis required |
| | = Qualitative analysis or Short answer required |
| | = Goal Seek or Solver cell |
| | = Crystal Ball Input |
| | = Crystal Ball Output |



## PROBLEM 3-13: Blended Profile Applied, per A

| Given | | | |
|---|---|---|---|
| Purchase Cost (pre-installed) $00( | $ (700,000) | Airframe Maintenance Cost | $ (2,100) |
| Installation $000 | $ (56,000) | Useful Life (yrs) Average | 20 |
| Downtime Days (installation) | 1 | Runway Savings | $ 500 |
| Downtime Cost/Day $000 | $ (5,000) | Facility cost | $ 1,200 |
| Salvage % | 15.00% | Depreciation | MACRS (see |
| Gen. Escalation | 3.00% | Fuel Price (all-in) | $ 0.80 |
| Marginal Tax Rate | 39.00% | Fuel (gallons saved) | 178,500 |
| Discount Rate | 9.28% | | |

| | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Winglet Purchase | $ (700,000) | | | | |
| Winglet Installation | $ (56,000) | | | | |
| Install. Downtime costs | $ (5,000) | | | | |
| Airport Reconfiguration | $ (1,200) | | | | |
| Fuel Savings | | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 |
| Airframe Maint. Costs | | (2,100) | (2,163) | (2,228) | (2,295) |
| Reduced restrictions (inflated 3%/yr) | | 500 | 515 | 530 | 546 |
| Less: depreciation | | (432,016) | (92,572) | (66,112) | (47,212) |
| EBIT | | $ (290,816) | $ 48,580 | $ 74,990 | $ 93,839 |
| Less: Income Tax | | (113,418) | 18,946 | 29,246 | 36,597 |
| Net Income | | $ (177,398) | $ 29,634 | $ 45,744 | $ 57,242 |
| Plus: Depreciation | | 432,016 | 92,572 | 66,112 | 47,212 |
| Operating Cash Flow | | $ 254,618 | $ 122,206 | $ 111,856 | $ 104,454 |
| Salvage Value | | | | | |
| Tax on Salvage Value | | | | | |
| Total Project Cash Flow | $ (762,200) | $ 254,618 | $ 122,206 | $ 111,856 | $ 104,454 |

**b.**

| | |
|---|---|
| NPV | $ 260,980 |
| IRR | 15.0% |
| MIRR | 10.9% |

### DEPRECIATION DETAILS

| MACRS Table | Normal Table | Normal Table x 50.00% | Year 1(a) Additional 50.00% | valid til 9/11/04 Total (modified table) | |
|---|---|---|---|---|---|
| 1 | 14.29% | 7.15% | 50.00% | **57.15%** | $ 756,000 |
| 2 | 24.49% | 12.25% | | **12.25%** | 756,000 |
| 3 | 17.49% | 8.75% | | **8.75%** | 756,000 |
| 4 | 12.49% | 6.25% | | **6.25%** | 756,000 |
| 5 | 8.93% | 4.47% | | **4.47%** | 756,000 |
| 6 | 8.92% | 4.46% | | **4.46%** | 756,000 |
| 7 | 8.93% | 4.47% | | **4.47%** | 756,000 |
| 8 | 4.46% | 2.23% | | **2.23%** | 756,000 |
| (a) Job Creation and Worker Assistance Act of 2002 | | | | 100.00% | |

**c.**

| | | |
|---|---|---|
| Breakeven fuel cost | $ 0.53 | per gallon |
| Breakeven fuel savings | 118,742 | gallons |

**d.**

| | Current Values | Best Case | Worst Case |
|---|---|---|---|
| **Changing Cells** | | | |
| Fuel Price | $ 0.80 | $ 1.10 | $ 0.50 |
| Gallons Saved | 178,500 | 214,000 | 142,000 |
| **Result Cells** | | | |
| NPV | $ 260,980 | $ 766,489 | $ (130,981) |
| IRR | 15.00% | 24.70% | 6.00% |
| MIRR | 10.90% | 13.10% | 8.30% |

**Notes:** Current Values column represents values of changing cells at time Scenario Summary Report was created.

**e.** Students should try to think of all possible qualitative and quantitative aspects of the project not already options excluded from the project: Southwest Airlines may be able to enter into new markets since the jets refueling. The jets can also carry more cargo with the greater fuel savings. It will make the airline more pr prices are high, especially when compared to their competitors with less fuel efficient jets. Potential risks, increased accidents because the jets handle differently and the wingspan is wider. There are other potenti students are encouraged to "brainstorm" these.

**f.** Impact on NPV and IRR if winglets have no salvage value.

| | |
|---|---|
| NPV | $ 250,123 |
| IRR | $ 14.89 |

## Aircraft B737-700

| |
|---|
| per year |
| |
| per year |
| per aricraft |
| below) |
| includes delivery, taxes and into plane charges |

| | |
|---|---|
| | = Value give |
| | = Formula/C |
| | = Qualitativ |
| | = Goal Seek |
| | = Crystal Ba |
| | = Crystal Ba |

### Solution

| | Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 |
| | (2,364) | (2,434) | (2,508) | (2,583) | (2,660) | (2,740) | (2,822) | (2,907) |
| | 563 | 580 | 597 | 615 | 633 | 652 | 672 | 692 |
| | (33,755) | (33,718) | (33,755) | (16,859) | | | | |
| | $ 107,244 | $ 107,228 | $ 107,134 | $ 123,973 | $ 140,773 | $ 140,712 | $ 140,650 | $ 140,585 |
| | 41,825 | 41,819 | 41,782 | 48,350 | 54,902 | 54,878 | 54,853 | 54,828 |
| | $ 65,419 | $ 65,409 | $ 65,352 | $ 75,624 | $ 85,872 | $ 85,835 | $ 85,796 | $ 85,757 |
| | 33,755 | 33,718 | 33,755 | 16,859 | | | | |
| | $ 99,174 | $ 99,126 | $ 99,107 | $ 92,483 | $ 85,872 | $ 85,835 | $ 85,796 | $ 85,757 |
| | | | | | | | | |
| | $ 99,174 | $ 99,126 | $ 99,107 | $ 92,483 | $ 85,872 | $ 85,835 | $ 85,796 | $ 85,757 |

| | Tax Depr |
|---|---|
| | $ 432,016 |
| | 92,572 |
| | 66,112 |
| | 47,212 |
| | 33,755 |
| | 33,718 |
| | 33,755 |
| | 16,859 |
| | **$ 756,000** |

included. The are real
s can fly further without
ice competitive when jet fuel
although remote, would be
al risks and benefits, and

**Solution Legend**

**en in problem**
**Calculation/Analysis required**
**e analysis or Short answer required**
**or Solver cell**
**ll Input**
**ll Output**

| 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|
| $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 | $ 142,800 |
| (2,994) | (3,084) | (3,176) | (3,272) | (3,370) | (3,471) | (3,575) | (3,682) |
| 713 | 734 | 756 | 779 | 802 | 826 | 851 | 877 |
| $ 140,519 | $ 140,450 | $ 140,380 | $ 140,307 | $ 140,232 | $ 140,155 | $ 140,076 | $ 139,994 |
| 54,802 | 54,776 | 54,748 | 54,720 | 54,691 | 54,661 | 54,630 | 54,598 |
| $ 85,716 | $ 85,675 | $ 85,632 | $ 85,587 | $ 85,542 | $ 85,495 | $ 85,446 | $ 85,397 |
| $ 85,716 | $ 85,675 | $ 85,632 | $ 85,587 | $ 85,542 | $ 85,495 | $ 85,446 | $ 85,397 |
| | | | | | | | $ 105,000 |
| | | | | | | | (40,950) |
| $ 85,716 | $ 85,675 | $ 85,632 | $ 85,587 | $ 85,542 | $ 85,495 | $ 85,446 | $ 149,447 |