Exercise AP-321

Establishing a park

The Economic Skills Project

1 Problem

Problem

A city is considering buying land over the next few years to establish a park. It would spend $120,000 a year on land in years 1-5. Beginning in year 6 the park would generate $50,000 a year in benefits to the public forever. What is the NPV of the park at an interest rate of 3%? Please round your answer to the nearest thousand dollars.

2 Answer

Answer

Here's the solution:

- $888k

3 Method

Solution method

Here's one approach:

1. Draw the cash flow diagram.

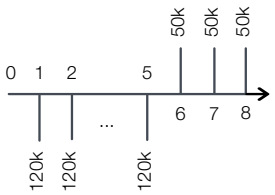
2. Split the cash flows into two groups: costs and benefits.
3. Use the finite stream PV formula for the costs.
4. Use the delayed infinite stream formula for the benefits.
5. Take the difference to find the NPV.

4 Solution

4.1 Step 1

Draw the cash flow diagram

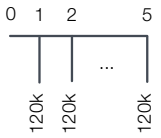
Here's how it looks:



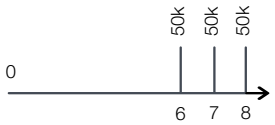
4.2 Step 2

Split the flows into two groups

Costs:



Benefits:



4.3 Step 3

Use the finite stream PV formula for the costs

The present value of an finite stream of identical payments F starting at time 1 and ending at T when the interest rate is r is given by:

$$PV = \frac{F}{r}\left(1 - \frac{1}{(1+r)^T}\right)$$

Filling in the other numbers and calculating the PV of the costs, PVC, gives:

$$PVC = \frac{\$120,000}{0.03}\left(1 - \frac{1}{1.03^5}\right)$$

$$PVC = \$550k$$

4.4 Step 4

Use the delayed infinite stream formula for the benefits

The present value of an infinite stream of identical payments F starting at time $T+1$ when the interest rate is r is given by:

$$PV = \frac{\frac{F}{r}}{(1+r)^T}$$

Filling in the other numbers and calculating the PV of the benefits, PVB:

$$PVB = \frac{\frac{\$50,000}{0.03}}{1.03^5}$$

$$PVB = \$1,438k$$

4.5 Step 5

Take the difference to find the NPV

Armed with the previous results, the NPV is straightforward:

$$\text{NPV} = \text{PVB} - \text{PVC}$$

$$\text{NPV} = \$1,438\text{k} - \$550\text{k}$$

$$\text{NPV} = \$888\text{k}$$

Done!