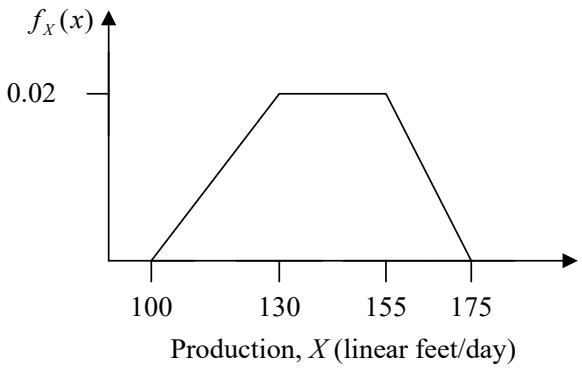
Homework 2 – Assigned: Wed. January 21, 2026, Due: Wed. January 28, 2026

Expected Value

1. The cost of constructing an irrigation water tunnel is estimated to have the following probabilities. Find its expected cost.

x_i	$P[x_i]$
\$1,250,000	0.2
\$1,500,000	0.4
\$1,750,000	0.3
\$2,000,000	0.1

2. The production of a trenching machine is uncertain. The estimated probability density function for its production is shown below. Find its expected value.



3. Shovel production in a gravel pit (continued from previous homework).

The operating cost per hour, Y, of an 8-hour day is estimated to have the following conditional probabilities for the given daily production rates, X:

$P[y_j \mid x_i]$	Operating Cost, y_j		
Output, x_i (cu yd/day)	\$4/hr	\$4.5/hr	\$5/hr
$x_1 = 800$	0.3	0.5	0.2
$x_2 = 900$	0.2	0.5	0.3
$x_3 = 1000$	0.2	0.4	0.4
$x_4 = 1100$	0.1	0.2	0.7

(a) Find the expected value of daily production, $E[X]$.
(b) Find the expected hourly cost, $E[Y]$.
(c) Find the expected unit cost (in \$/cu.yd). (Note: $E[U/V] \neq E[U]/E[V]$, i.e., the expected value of a ratio does not equal the ratio of the expected values.)

Engineering Economy

1. A ready-mix concrete company is studying the possible construction of a new plant, and their sales depend upon the level of construction in the area served by the plant. The possible levels are A, B, and C with probabilities of occurrence of 0.3, 0.6, and 0.1, respectively. The annual profit for each level of sales for the end of each of the next 5 years is shown below. The cost of the plant is $6,000,000 to be paid now (at time zero).

	End-of-Year Profit ($Million)					
Level	0	1	2	3	4	5
A	-6.0	0.5	1.0	1.5	1.5	1.5
B	-6.0	2.0	2.0	2.0	2.0	2.0
C	-6.0	1.0	2.0	3.0	3.0	3.0

If the company requires a 12% rate of return, what is the expected net present value of this investment?

2. A precast concrete firm must purchase steel forms for twin-tee sections at a cost of $1200 for each form. They expect to use each form 250 times per year and want to calculate the purchase amount that should be allocated to each section cast. The life of each form has the following probabilities:

P[1000 uses] = 0.3
P[1250 uses] = 0.4
P[1500 uses] = 0.2
P[1750 uses] = 0.1

Assume that each year's expense is at the end of the year, and that the original purchase is at the start of the first year. What expected cost should be allocated to each twin tee cast, if the company requires a 12% rate of return on this investment?

Hint: Let X be the uncertain life of each form in years. What is needed is an easy way to translate the payment of $1200 every X years into an equivalent constant amount A paid each year. The annuity amount A should then be divided by 250 to obtain Y (in $/use), which is the cost that should be allocated to each section cast for that life X. The expected value E[Y] is the purchase amount that should be allocated to each section cast.
Note that since the number of uses per year is 250, the PMF for the number of uses (given above) implies that the sample space for X (i.e., the life of each form in years) is x = 4,5,6,7 years. For each possible value of X, compute the corresponding annuity amount A that has a present value of $1200. That annuity amount, A, if paid every year forever, would be the yearly cost that is equivalent to the company paying $1200 repeatedly every X years to purchase forms that have that particular value of life, X.