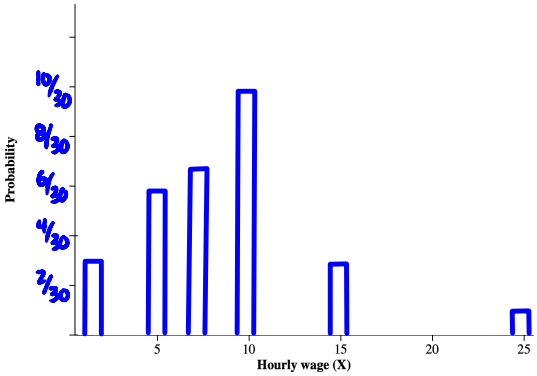
Is It Time For a Raise?

The employees have been working very hard and it's time to give them a raise. The boss is trying to decide if she should give everyone a $10 raise (add $10 per hour) or double everyone's wage (multiply by 2).

1. Copy the probability distribution from the previous lesson below. Graph, then use technology to find the mean and standard deviation.

X	1	5	7	10	15	25
Probability	3/30	6/30	7/30	10/30	3/30	1/30

Mean: $8.40 = M Standard Deviation: $4.76 = σ



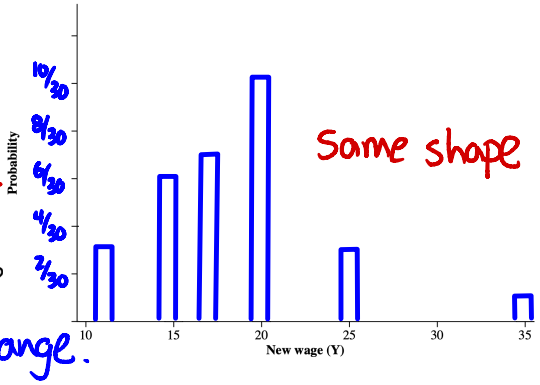
2. To make a decision about what raise should be given, complete the tables and graphs below and calculate the new mean and standard deviation using technology.

a. **Option 1:** Add $10 per hour to the old wage for all employees (shift)

add 10 →

X = *Old Wage*	1	5	7	10	15	25
Y = New Wage	11	15	17	20	25	35
same → Probability	3/30	6/30	7/30	10/30	3/30	1/30

Mean: $18.40 = M+10 Standard Deviation: $4.76 = σ



How did adding a constant affect the mean and standard deviation?

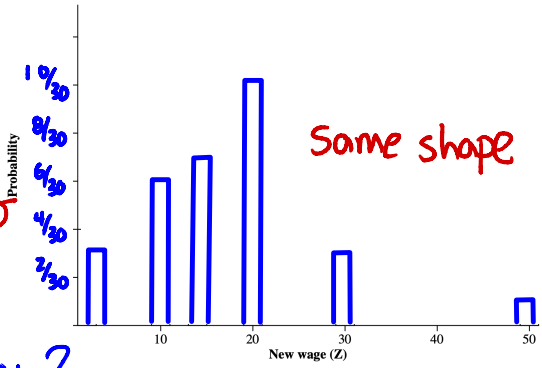
The mean is increased by $10. SD did not change.

b. **Option 2:** Double the old wage for all employees (stretch)

mult. by 2 →

X = *Old Wage*	1	5	7	10	15	25
Z = New Wage	2	10	14	20	30	50
same → Probability	3/30	6/30	7/30	10/30	3/30	1/30

Mean: $16.80 = 2M Standard Deviation: $9.52 = 2σ



How did multiplying by a constant affect the mean and standard deviation?

Both the mean and SD were multiplied by 2.

3. Which option would you prefer? Why?

If your old wage is $1, $5, or $7 → option 1
If your old wage is $15 or $25 → option 2

Lesson 6.3 – Transforming Random Variables

QuickNotes

LT#1 Add or subtract a constant c

Shape: stays the same

Center: add/subtract c
↳ (mean, median)

Variability: stays the same
↳ (range, IQR, SD, variance)

LT#2 Multiply or divide by constant c

Shape: stays the same

Center: multiply/divide by c

Variability: multiply/divide by c (range, IQR, SD)

multiply/divide by c^2 (variance)

Check Your Understanding

Let X = the number billionaires in a randomly selected state. Based on current records, the probability distribution of X is as follows:

Number of Billionaires	0	1	2	3	4	5	6	8	9	10	11	12	13	17	56	58	118	165
Probability	0.10	0.24	0.06	0.06	0.04	0.08	0.04	0.04	0.06	0.08	0.02	0.02	0.02	0.06	0.02	0.02	0.02	0.02

The random variable X has mean $\mu_x = 12.68$ and standard deviation $\sigma_x = 29.02$. Suppose a law is passed requiring each billionaire to pay a \$7,000 tax to their state. Let Y = the tax money received by a randomly selected state.

$Y = 7{,}000X$ (stretch)

1. For a state that has 9 billionaires (X = 9), how much tax money (Y) would they receive?

$9 \times 7{,}000 = \$63{,}000$

2. Consider the graph of the probability distribution of X and a separate graph of the probability distribution of Y. How would their shapes compare?

the shape of both X and Y would be the same (skewed right) because the probabilities would be the same.

3. Find the mean and standard deviation of Y.

$\mu_Y = 7{,}000\,\mu_X$

$= 7{,}000(12.68) = \$88{,}760$

$\sigma_Y = 7{,}000\,\sigma_X$

$= 7{,}000(29.02) = \$203{,}140$

4. Each state agrees to invest \$20,000 of the tax money they receive to improve roads. Therefore, the net amount (N) of money a randomly selected state has left to spend is $N = Y - \$20{,}000$. Describe the shape, mean, and standard deviation of the probability distribution of N. (shift)

Shape: same as Y (skewed right)

mean: $\mu_N = \mu_Y - 20{,}000 = 88{,}760 - 20{,}000 = \$68{,}760$

Standard deviation: $\sigma_N = \sigma_Y = \$203{,}140$

Math Medic