March 25, 2025

STAT REVIEW

1.5 pages = Mult. choice/Matching ← #6-8 Journal

Central Tend. = *Mean, Median, Mode

Variation = *Range, St. Dev., IQR

#15 Types of Sampling: Random, Systematic, Stratified, Cluster, Conven.

Interview every 5th person in lunch system = Syst.

Picker wheel - Random

Randomly select 10 flights into KC & interview every passenger — Cluster

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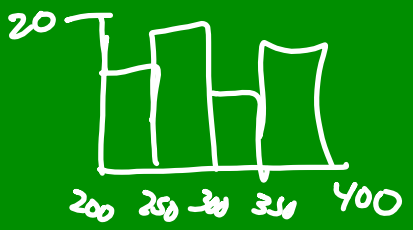
Calculator problems

* Create histogram or box plot.



1-VAR STATS

Mean =

Median =

Mode =

Range =

IQR =

St. Deviation =

By Hand

Mean = $\frac{\text{Sum of data}}{\text{\# of items}}$

Median = 35 items

$\frac{35}{2} = 17.5 \simeq 18^{th}$

$\frac{300}{2} = 150^{th} + 151^{st}$

4	· 70	= 280
⇒6	· 80	= 480
2	· 90	= 180
12		940

Mean = $\frac{940}{12} = 78.\overline{33}$

Median = $\frac{12}{2} = 6^{th} + 7^{th} = 80$

Data in order!

Mode = 80

St. Deviation

{22, 38, 77, 83}

Range = 102 − 33
= 69

Median: $\frac{38}{2} = 19^{th} + 20^{th}$

$\frac{85+86}{2} = 86.5$

Quartiles: $\frac{19}{2} = 9.5 \approx 10^{th}$

$Q_1 = 57$ $Q_3 = 99$

10	0 1 1 1 2 2 2
9	0 2 4 4 5 5 9 9 9 9
8	1 1 1 2 2 5 8 9
7	1 4 9
6	
5	0 2 2 4 6 7
4	0 5 6
3	3

8|1 = 81
38 scores

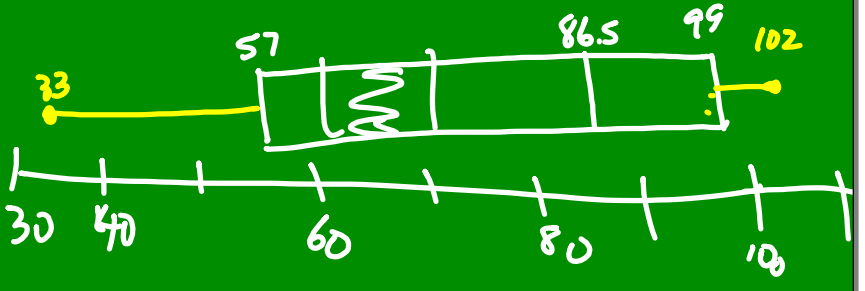
Outliers

IQR = 99 − 57 = 42

1) IQR * 1.5 = #
42 * 1.5 = 63

2) lower boundary:
57 − 63 = −6

3) Upper boundary:
99 + 63 = 162



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Normal Distribution

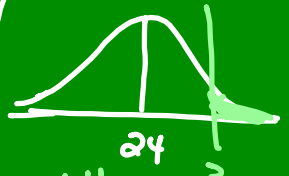
$$Z = \frac{x - \mu}{\sigma} = \frac{\text{Raw score} - \text{Mean}}{\text{St. Dev}}$$

$\bar{x} = 24$ mpg

$\sigma = 4$ mpg

How many are above 30 mpg?

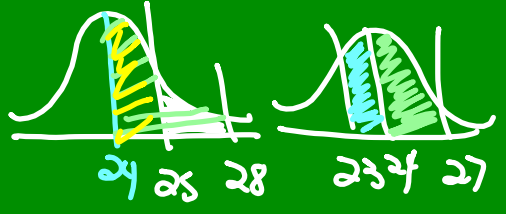
2000 SUV

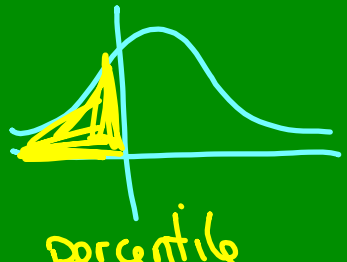


$$Z = \frac{30 - 24}{4} = 1.50$$

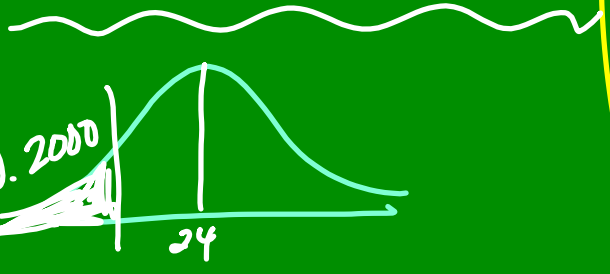
0.0668 × 2000

= 133.6 SUVs





percentile



What is cutoff for lowest 20%

$$-0.84 = \frac{x - 24}{4}$$

$-3.36 = x - 24$

$+24 \quad +24$

20.64 mpg = x

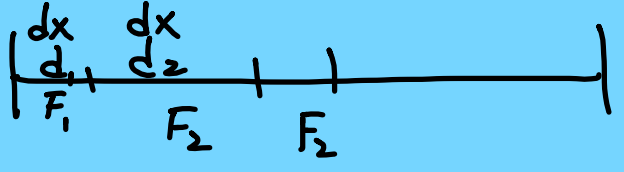
Work

Work = Force · Distance

Joules = $N \cdot m$ J, ft-lb.

$= lb \cdot ft$

$$W = \int F(x)\,dx$$



40 ft. deep

Bucket full = 30 lb.

- Loses $\frac{1}{4}$ lb for each ft. raised
- How much work to raise bucket?

$$\int_0^{40} \left(30 - \tfrac{1}{4}x + 70\right) dx$$

$$\int_0^{40} \left(100 - \tfrac{1}{4}x\right) dx$$

$$= 100x - \tfrac{1}{8}x^2 \Big|_0^{40}$$

$$= 4000 - 200$$

$$= 3800 \text{ ft-lb.}$$

$$\frac{3800}{550}$$

$$= 6.91 \text{ ft-lb.}$$

1 hp = 550 ft-lb

Crane – raises bucket of sand = 500 lb.
– lifts from ground to 50 ft in 10 sec.
– Sand spills out 10 lb/sec
– Cable weighs 5 lb/ft.
– How much work to raise it 13.5 ft?

$\frac{10 \text{ lb}}{\text{sec}} \cdot \frac{10 \text{ sec}}{50 \text{ ft}} = 2 \text{ lb/ft}$

$$\int_0^{13.5} \underbrace{(500-2x)}_{\text{bucket/sand}} + \underbrace{(250-5x)}_{\text{s. so'}} dx$$

$$\int_0^{13.5} (750-7x)\,dx$$

$$\approx 9487 \text{ ft} \cdot \text{lb}.$$

SPRINGS

Hooke's Law

$$F(x) = Kx$$

K: spring constant

x: # of units stretched/compressed beyond natural length

Spring: natural length = 1 m
A force of 8 N to stretch 3 m.
How much work is required to stretch it from 2 m to 4 m?

$F = Kx$

$8 = K \cdot 2$

$4 = K$

$$\int_1^3 4x\,dx$$

$$= 2x^2 \Big|_1^3$$

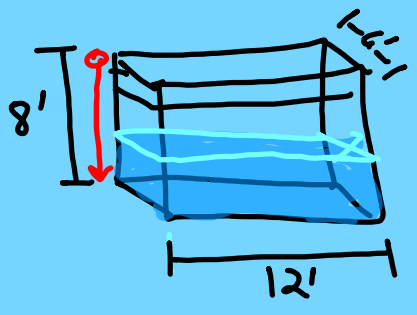
$W = 18 - 2$

$W = 16$ J

Pump Problems

ρ = Weight density of water

$62.4 \frac{lb}{ft^3}$ $\quad$ $9810 \frac{N}{m^3}$



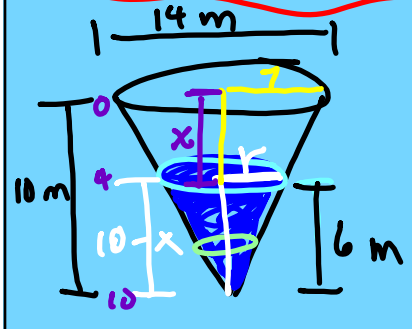
Water is 7.5' deep

$$\int \rho \; A(x) \; \text{depth} \; dx$$

$$\int_{0.5}^{8} 62.4 \cdot (12 \cdot 6) \; x \; dx$$

$$\int_{0.5}^{8} 4492.8 \, x$$

$$W = 143{,}208 \text{ ft} \cdot \text{lb}$$



How much work to pump water to top?

$$\int \rho \cdot A \cdot \text{depth} \, dx$$

$$\int_{4}^{10} 9810 \cdot \underbrace{\pi \cdot \left[\frac{7}{10}(10-x)\right]^2}_{\text{Area}} \cdot x \cdot dx$$

(πr^2)

$$\frac{r}{7} = \frac{10-x}{10}$$

$$r = \frac{7}{10}(10-x)$$

$$\approx 5{,}980{,}123.4 \text{ J}$$