

== **Begin 6.3** ==

1 **Corresponding Areas** under a normal curve and the standard normal curve are equal.

Below: Area B = Area A.

PRGM	A normal distribution		The standard normal distribution	PRGM
NORMAL	$\mu = 50$	\rightarrow	$\mu = 0$	NORMAL
2	$\sigma = 10$	\rightarrow	$\sigma = 1$	1
MU=50	$x_1 = 50$	\rightarrow	$z_1 = 0$	3:P(L<Z<R)
$\sigma X=10$	$x_2 = 65$	\rightarrow	$z_2 = 1.5$	L=0
1	$P(50 < x < 65) = .4332$	\leftarrow	$P(0 < z < 1.5) = .4332$	R=1.5
3:P(L<X<R)				
L=50				
R=65				

$$z = \frac{x - \mu}{\sigma}$$

$$z = \frac{65 - 50}{10} = 1.5$$

$$z(65) \rightarrow 1.5$$

$$z(50) = 0$$

A normal distribution x has $\mu = 50$ and $\sigma = 10$. Find $P(50 < x < 65)$.

The traditional method is to convert the x values 50 and 65 to their corresponding z scores 0 and 1.5 using the z -score formula. Next, use the areas of the standard normal table to find $A(0) = .5000$, $A(1.5) = .9332$ $.9332 - .5000 = .4332 \rightarrow P(0 < z < 1.5) \rightarrow P(50 < x < 65) = .4332$

Page 332, 26b Given a ND with $\mu = 8.4$ and $\sigma = 1.7$. Let x = the police response time (in minutes).

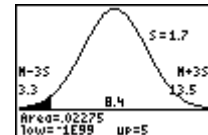
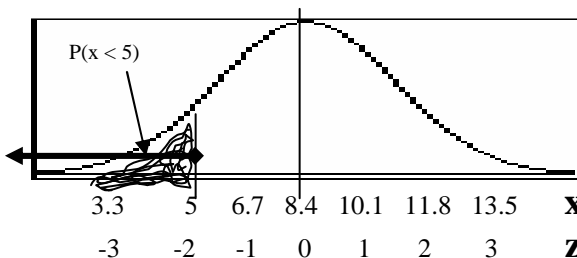
(b) Find the probability that the police respond within 5 minutes. That is find $P(x < 5)$.

PRGM	INTERVAL	ON	1	PRGM	NORMAL
M=8.4	M-3S=	3.3		NORMAL	MU=8.4
S=1.7	M-2S=	5.0		1:Z	sigma=1.7
n=71	M-S=	6.7		2:Z	n=1
	M=	8.4		3:Z	n>1
	M+S=	10.1			
	M+2S=	11.8			
	M+3S=	13.5			

PRGM	PROBABILITY	PRGM	NORMAL
1:PROBABILITY	L:area	MU=8.4	
2:BOUNDARY	r.area	sigma=1.7	
		n=1	
		n>1	
		Z=-2	
		PROB=.02275	

$P(x < 5) \approx .02275$

Draw the graph, showing intervals.



*By table: $z(5) = -2$
 $A(-2) = .0228$
 $P(z < -2) \approx .0228$
 $P(x < 5) \approx .0228$*

About 2% of the time, the response time is less than 5 minutes.

Page 333, 31d Given $\mu = 8$. When σ is not given, use the general rule: $\sigma \approx \frac{\text{Range}}{4} = \frac{11-5}{4} = 1.5$.

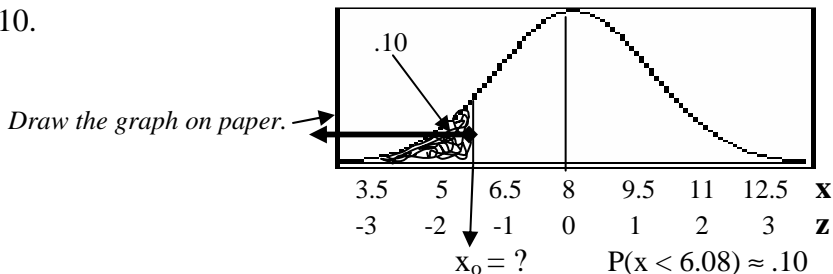
Let x be the replacement age of a TV set.

(d) Find x_0 , the guaranteed age of a TV, so that no more than 10% of the sets are in the guarantee period.

That is, find x_0 so $P(x < x_0) \approx .10$.

```

PRGM INTERVAL
M=?8
S=?1.5
n=?1
M-3S= 3.5
M-2S= 6.0
M-S= 9.0
M= 12.0
M+S= 13.5
M+2S= 15.0
M+3S= 16.5
  
```



Use the **NORMAL** program to find the boundary of the known Left Area.

PRGM NORMAL

```

NORMAL TYPE
1:Z M=0, S=1
2:X n=1
3:X n>1
MU=?8
σx=?1.5
FIND
1:PROBABILITY
2:BOUNDARY
KNOWN
1:LEFT AREA
2:RIGHT AREA
3:CENTRAL AREA
AREA=? .10
Z=
BOUNDARY=
-1.28155
6.07767
  
```

$P(x < 6.08) \approx .10$

Conclusion:

If the company guarantees their sets for 6 years, they will not have to replace more than 10% of them.

The Traditional Method: ← *Optional* Find x_0 so $P(x < x_0) \approx .10$.

First find z_0 so $P(z < z_0) \approx .10$ using steps 1-4.

- 1 Draw left tail area C so that it contains 10% of the distribution. Mark the boundary z_0 .
- 2 Look for .1000 in the body of the SNC table. .1000 is between .1003 and .0985.
- 3 Choose .1003 since it is closer to .1000.
- 4 The z-score that corresponds to .1003 is -1.28. → $z_0 = -1.28$.

Next find x Use $x = z\sigma + \mu$ to find x_0 . → $x_0 = -1.28 \times 1.5 + 8 \approx 6.1$ So $P(x < 6) \approx .10$. $x_0 = 6$.

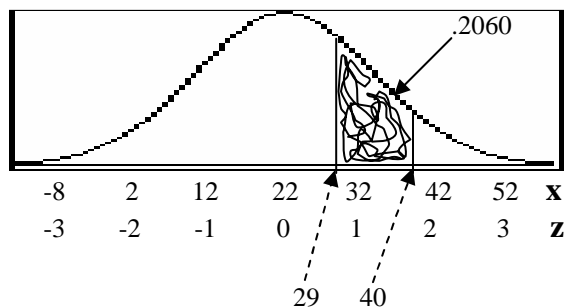
Page 332, 28 Given a ND with $\mu = 22$ and $\sigma = 10$. Let x = the daytime high temperature. Find $P(29 < x < 40)$.

PRGM NORMAL 2 MU=22 σx=10 1 3 L=29 R=40

By table: $z(29) = .7$ $z(40) = 1.8$
 $A(.7) = .7580$, $A(1.8) = .9641$
 $.9641 - .7580 = .2061$

```

MU=?22
σx=?10
FIND P(L<X<R)
L=?29 Z=? .7
R=?40 Z=? 1.8
PROB=.206033
  
```



Result: PROB = .2060... $P(29 < x < 40) \approx .2060$

Conclusion:

The temperature is between 29° and 40° on about 21% of the days in January. $.206 \times 31 \approx 6$ days. There are approximately 6 days in January when the daytime high temperature is between 29° and 40°.

Begin 7.1

A Parameter is a number that is a descriptive measure of a population. μ and σ are parameters. Page 360

A Statistic is a number that is a descriptive measure of a sample. \bar{x} and s are statistics. Page 360

A Sampling Distribution of \bar{x} is a **probability distribution** formed by all the means \bar{x} of all the samples, all of size n , from a population. This is called the \bar{x} distribution. See sheet 4. Page 361

Consider all K samples of size n from a population x : $S_1, S_2, S_3, \dots, S_K$.
The probability distribution of all the means: $\bar{x}_1, \bar{x}_2, \bar{x}_3, \dots, \bar{x}_K$ is the \bar{x} distribution.

7.2

The Mean of the \bar{x} Distribution is denoted $\mu_{\bar{x}}$. Page 366

The Standard Deviation of the \bar{x} Distribution is denoted $\sigma_{\bar{x}}$. Page 366
 $\sigma_{\bar{x}}$ is also called The Standard Error of the Mean and denoted SE Mean.

Three Properties of the \bar{x} Distribution are Page 366

- a) If the population is normal, then the \bar{x} distribution is normal. b) $\mu_{\bar{x}} = \mu$. c) $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

Consider a population x with $\mu = 100$ and $\sigma = 20$. Let \bar{x} denote the \bar{x} distribution for samples of size $n = 25$.

- a) If x is normal, then the \bar{x} distribution is also normal. b) $\mu_{\bar{x}} = 100$. c) $\sigma_{\bar{x}} = \frac{20}{\sqrt{25}} = \frac{20}{5} = 4$.

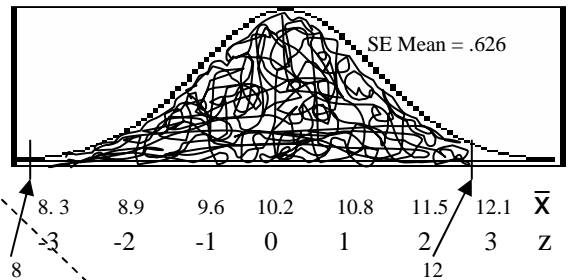
The Central Limit Theorem states: a) The \bar{x} distribution from any population is usually normal when $n > 29$,
 b) $\mu_{\bar{x}} = \mu$, and c) $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ See sheet 11. Page 368

Page 366, 2b A normal population has $\mu = 10.2$ and $\sigma = 1.4$. Five fish are caught. $\rightarrow n = 5$. \leftarrow

Let \bar{x} be the mean (average) length of the 5 fish. Find $P(8 < \bar{x} < 12)$.

The \bar{x} Distribution with $n = 5$

The \bar{x} distribution has $\mu_{\bar{x}} = 10.2$ and $\sigma_{\bar{x}} = \frac{1.4}{\sqrt{5}} \approx .626 = \text{SE Mean}$.



PRGM INTERVAL M=10.2 S=1.4 n=5 \rightarrow Draw the graph \rightarrow

PRGM NORMAL 3 MU=10.2 σ_x =1.4 n=5 1 3 L=8 R=12.

Result: PROB \approx .9978 $P(8 < \bar{x} < 12) \approx 99.8\%$.

The probability is 99.8% that the average length of the 5 fish will be between 8 and 12 inches.

Note: $z(8) \approx -3.51$. $z(12) \approx 2.87$.

$A(-3.51) = 0$

$$z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{8 - 10.2}{\frac{1.4}{\sqrt{5}}} = -3.51$$

```
MU=?10.2
 $\sigma_x$ =?1.4
n=?5
SE MEAN=.6261
P(L< $\bar{x}$ <R)
L=?8 Z=-3.514
R=?12 Z=2.875
PROB=.997759
```

PRGM ZTXVALUE M=10.2 S=1.4 n=5 Select 4 \rightarrow SE Mean = .626 = $\sigma_{\bar{x}}$.

===== An Example of a Sampling Distribution of \bar{x} =====

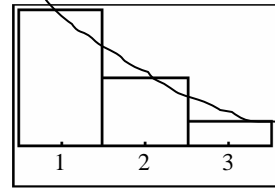
Consider the population x : 1,1,1,1,1,2,2,2,3. $N = 10$, $\mu = 1.5$, $\sigma \approx .671$

L1	L2	L3	3
1	.6		
1	.6		
1	.6		
1	.6		
1	.6		
1	.6		
1	.6		
1	.6		
1	.6		
L3()			

x	1	2	3
P(x)	.6	.3	.1

The Probability Distribution of x

M=	1.5
Med=	1
σ_x =	.6708203932
σ_x^2 =	.45



The x Distribution

From the population, all samples of size $n = 3$ are selected *with replacement*. With replacement means that after each number is selected, it is returned to population *before* the next number is selected.

There are 1000 samples. 27 are different samples. There are 7 different values of \bar{x}

$10 \times 10 \times 10$ $3 \times 3 \times 3$

The different samples

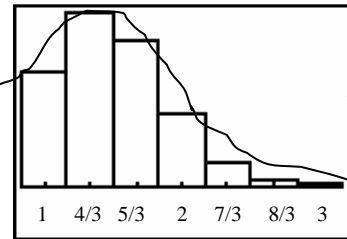
Sample S	\bar{x}	P(S)
1,1,1	1	.216
1,1,2	4/3	.108
1,1,3	5/3	.036
1,2,1	4/3	.108
1,2,2	5/3	.054
1,2,3	2	.018
1,3,1	5/3	.036
1,3,2	2	.018
1,3,3	7/3	.006
2,1,1	4/3	.108
2,1,2	5/3	.054
2,1,3	2	.018
2,2,1	5/3	.054
2,2,2	2	.027
2,2,3	7/3	.009
2,3,1	2	.018
2,3,2	7/3	.009
2,3,3	8/3	.003
3,1,1	5/3	.036
3,1,2	2	.018
3,1,3	7/3	.006
3,2,1	2	.018
3,2,2	7/3	.009
3,2,3	8/3	.003
3,3,1	7/3	.006
3,3,2	8/3	.003
3,3,3	3	.001
sum	→	1

$P(1,1,1) = .6 \times .6 \times .6 = .216$
 $P(1,1,2) = .6 \times .6 \times .3 = .108$
 $P(1,1,3) = .6 \times .6 \times .1 = .036$
 $P(1,2,2) = .6 \times .3 \times .3 = .054$

The \bar{x} distribution

\bar{x}	P(\bar{x})	f
1	.216	1
4/3	.324	3
5/3	.270	6
2	.135	7
7/3	.045	6
8/3	.009	3
3	.001	1
sum	1	27

$P(1) = .216$
 $P(4/3) = .108 + .108 + .108 = .324$
 $P(5/3) = .036 + .054 + .036 + .054 + .054 + .054 = .270$
 Note that $P(5/3) \neq 6/27$ because values of 5/3 are not equally likely.



The \bar{x} distribution

L1	L2	L3	3
1	.216		
1.3333	.324		
1.6667	.270		
2	.135		
2.3333	.045		
2.6667	.009		
3	.001		
L3()			
M=	1.5		
Med=	1.3333333333		
σ_x =	.3872983346		
σ_x^2 =	.15		

USE [PRGM] **PROBDIST**

$\mu_{\bar{x}} = 1.5$, $\sigma_{\bar{x}} \approx .387$

Checking the theory: $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{.671}{\sqrt{3}} \approx .387$

also, $\mu_{\bar{x}} = \mu$

[PRGM] **ZTXVALUE** M=1.5 S=.671 n=3 Select 4 . → SE Mean $\approx .387 = \sigma_{\bar{x}}$.

See sheet 10

Page 374, 8 Let x be (the white blood cell count) per (mm^3 of whole blood).

x is a normal distribution with $\mu = 7500$ and $\sigma = 1750$. (a) Find $P(x < 3500)$ for $n = 1$, a single blood sample.

Use **PRGM INTERVAL** to help make the graph.

PRGM NORMAL 2 MU=7500 $\sigma_x=1750$ 1 1 R = 3500

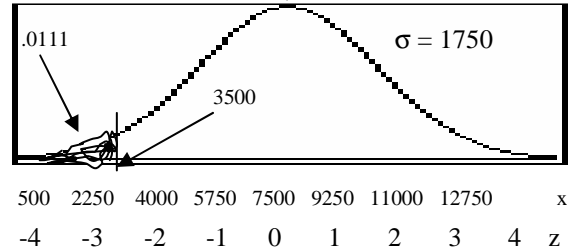
Result: PROB = .011135...

$P(x < 3500) \approx 1.1\%$

Note: $z(3500) = -2.29$.

$$z = \frac{x - \mu}{\sigma} = \frac{3500 - 7500}{1750} = -2.29$$

```
MU=?7500
 $\sigma_x$ =?1750
FIND P( $x$ <R)
R=?3500
Z=-2.2857
PROB=.011135
```



(b) Find $P(\bar{x} < 3500)$ for $n = 2$, for two blood samples.

PRGM NORMAL 3 MU=7500 $\sigma_x=1750$ n=2 1 1 R = 3500

Use **PRGM INTERVAL**

M=7500
S=1750
n=2

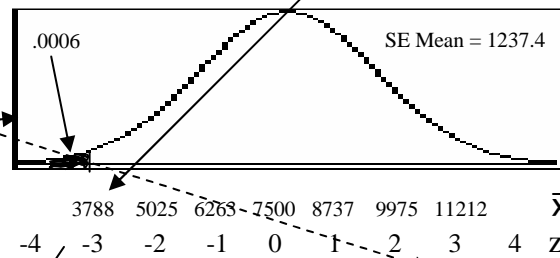
Result: PROB = .000614

$P(\bar{x} < 3500) \approx .0006$

Note: $z(3500) = -3.23$.

Draw this on paper.

$$z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{(3500 - 7500)}{\left(\frac{1750}{\sqrt{2}}\right)} = -3.23$$



Use **PRGM ZTXVALUE M=7500 S=1750 n=2 -1**

```
MU=?7500
 $\sigma_x$ =?1750
n=?2
SE MEAN=1237.436
FIND P( $\bar{x}$ <R)
R=?3500
Z=-3.2325
PROB=6.14E-4
```

(c) Find $P(\bar{x} < 3500)$ for $n = 3$, for three blood samples.

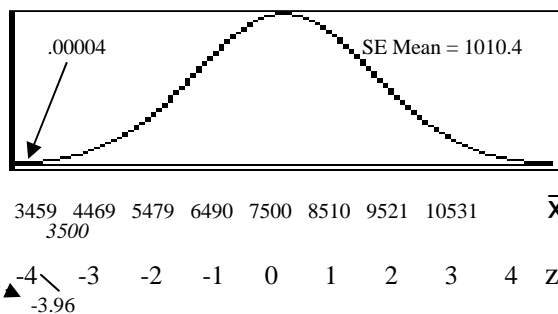
PRGM NORMAL 3 MU=7500 $\sigma_x=1750$ n=3 1 1 R = 3500

Use **PRGM INTERVAL**

```
MU=?7500
 $\sigma_x$ =?1750
n=?3
SE MEAN=1010.363
FIND P( $\bar{x}$ <R)
R=?3500
Z=-3.959
PROB=3.8E-5
```

$P(\bar{x} < 3500) \approx .00004 = .004\%$

Note: $z(3500) = -3.96$.



M=7500
S=1750
n=3

Use **PRGM ZTXVALUE M=7500 S=1750 n=3 1 3500**

8.1 & 8.2

These sections develop the concept of a Confidence Interval for μ .

A confidence interval is an interval that is estimated to contain μ with a given level of confidence or reliability.

For example, you can say that μ is estimated to be in the interval (2, 4) with 99% confidence. $2 < \mu < 4$.

1 **The Confidence Level c** is the reliability of the confidence interval.

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c is written as a percent. $c = 95\%$ or $c = 99\%$ are typical confidence levels.

c corresponds to a central area under a t curve found inside the back cover of our book.

A number c_v called a critical value determines the central area c .

2 **The Critical Value cv** , denoted z_c or t_c , is the right boundary of the central area c .

cv is found in the t table in the book (*inside back cover*). Use c in the top row and $d.f. = n - 1$ on the side. z_c critical values are in the bottom row of the t table. t_c critical values are in the body of the table.

→ We will find cv using **PRGM CV**. ←

PRGM CV

```

KNOW
1:C CENTRAL AREA
2:A' 1-TAIL R
3:A' 1-TAIL L
4:A' 2-TAIL
    
```

```

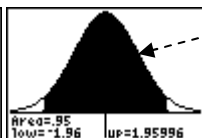
c=? .95
    
```

```

FIND
1:t
2:z
    
```

```

c=? .95
CV z=
-1.95996
CV z=
1.95996
    
```



.950 = c

$z_{.95} = 1.96$

PRGM CV

```

KNOW
1:C CENTRAL AREA
2:A' 1-TAIL R
3:A' 1-TAIL L
4:A' 2-TAIL
    
```

```

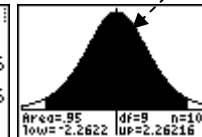
c=? .95
    
```

```

FIND
1:t
2:z
    
```

```

c=? .95
n=? 10
CV t=
-2.26216
CV t=
2.26216
df=9
    
```



$n = 10$
 $t_{.95} = 2.262$

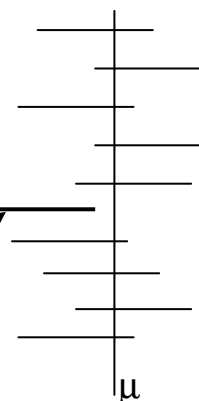
3 **A c Confidence Interval for μ** is an interval cCI that is estimated to contain μ with a c level of confidence.

Example: A 95% CI for μ is estimated to contain μ with a 95% level of confidence.

If we say that we are 90% confident that the 90% CI contains μ , we mean that if we have all of the 90% confidence intervals of all the samples of size n from the population, then μ would be in 90% of these intervals.

9 out of 10 of the 90% C intervals will contain μ .

One out of 10 of the 90% C intervals will not contain μ .



To find a confidence interval for μ we need: 1. a sample of size n , 2. \bar{x} called A Point Estimate of μ
3. c , 4. σ or s , 5. cv , 6. the formula (or Interval function in the TI) for the cCI .

4 **The cCI for μ when σ is given** is $cCI = \left(\bar{x} \pm z_c \cdot \frac{\sigma}{\sqrt{n}} \right)$. This is the ZInterval. *With σ , use z_c .*

5 **The cCI for μ when σ is **not** given** is $cCI = \left(\bar{x} \pm t_c \cdot \frac{s}{\sqrt{n}} \right)$. This is the TInterval. *With s , use t_c .*

Note: If the sample is small, then the population must be “normal” to use formula 4 or 5.

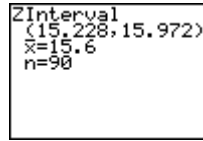
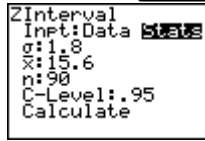
Here “normal” means: mound shaped, unimodal, and not extremely skewed.

A Small Sample has $n \leq 29$. A sample is small if $n = 2, 3, \dots, 29$.

A Large Sample has $n \geq 30$. A sample is large if $n = 30, 31, 32, \dots$

Page 405, 2 $n = 90, \bar{x} = 15.60, \sigma = 1.80$. Find the 95% confidence interval for μ , her true average.
 Since σ is given, a ZInterval is used.

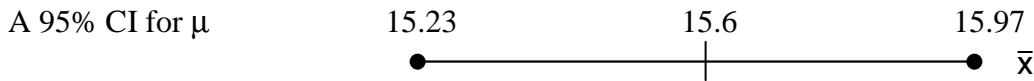
[STAT] [7] put cursor on Calculate [ENTER]



(Lower bound, Upper bound)

95% CI = (15.23, 15.97)

We are 95% confident that her average time μ is between 15.23 and 15.97 minutes.



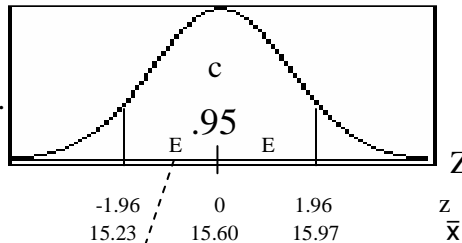
Optional Method

By formula: $cCI = \left(\bar{x} \pm z_c \cdot \frac{\sigma}{\sqrt{n}} \right)$. [PRGM] [CV] 1:c c=.95 2:Z. → 1.95996 = z_c .
 95% CI = $\left(15.6 \pm 1.95996 \cdot \frac{1.8}{\sqrt{90}} \right) = (15.228, 15.97)$. The cv of the 95% ZInterval.
 Keys for the lower bound: $15.6 [-] 1.95996 [\times] 1.8 [\div] [2nd] [\sqrt{90}] [ENTER] \rightarrow 15.228$

Page 405, 2 continued

$E = 15.97 - 15.60 = .372 =$ maximum error.

ZInterval (15.228, 15.972) x=15.6 n=90	x=15.6 n=90
15.972-15.6	.372

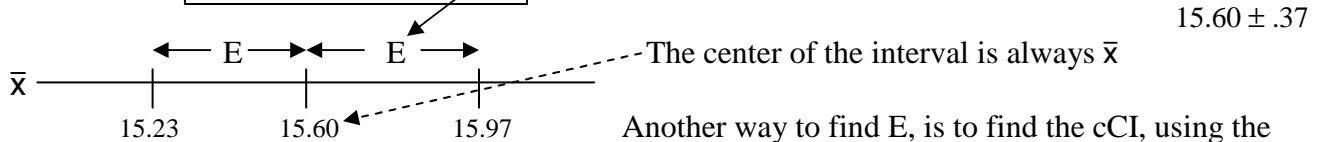


$$\frac{15.6 - 1.95996 \cdot 1.8}{\sqrt{90}} = 15.22812374$$

6 The Maximum Error of Estimate E of the cCI is $E = cv \cdot \frac{SD}{\sqrt{n}}$

$|\mu - \bar{x}|$ is called The Margin of Error.

In the problem above, $E = 1.95996 \cdot \frac{1.8}{\sqrt{90}} \approx .37$. The 95% CI would be $(15.60 - .37, 15.60 + .37) = (15.23, 15.97)$



Another way to find E, is to find the cCI, using the method at the top of the page, then subtract \bar{x} from the upper bound. $E = 15.97 - 15.60 = .37$ min. $.37 \times 60 \text{sec} = 22.2 \text{sec}$.

7 Student's t Distribution is given by $t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$ using \bar{x} of all samples, of size n, from the population.

The Student's t distribution is used when σ is unknown. The normal distribution z is used if σ is known.

If n is small, $n < 30$, then the population must be "normal" to use the t distribution.

A t distribution has $\mu = 0$ and $\sigma = \sqrt{\frac{n-1}{n-3}}$. Every sample size n forms its own t distribution.

See **page 413** for examples of t graphs for $n = 4$ and $n = 6$. When $n = \infty$, (the t curve) = (the z curve).

8 **The Number of Degrees of Freedom d.f.** for a t interval is the number $d.f. = n - 1$.

If $n = 10$, then $d.f. = 10 - 1 = 9$. Also $n = d.f. + 1$.

The equation $(x + y + z = 20)$ has 2 degrees of freedom. We are *free* to select values for two of the variables, say x and y . Then, z must be computed. For example if we select $x = 8$ and $y = 7$, then z must be 5. The equation $(a + b + c + d + e = 10)$ has 4 degrees of freedom.

416, 4

STAT 1

STAT 8 put cursor on Calculate **ENTER**

$cv = 3.707$
 $E = 1.67$

A 99% CI = (44.5, 47.8).

417, 3

STAT 8 put cursor on Calculate **ENTER**

$cv = 2.028$
 $E = .11$

A 95% CI = (6.64, 6.86)

Begin 8.3

9 **The Point Estimate \hat{p}** for p in a binomial experiment with n trials and r (x) successes is $\hat{p} = \frac{r}{n} = \frac{x}{n}$ Page 426

The point estimate for q is $\hat{q} = 1 - \hat{p}$. p is the probability of success or the proportion of successes.

A sample $n = 800$ students was taken from a population of 20000 students and given flu shots. Of the 800, 600 do not get the flu. We estimate the probability p that any student in the 20000 that got a shot will not get the flu to be $\hat{p} = \frac{600}{800} = 75\%$. $\hat{p} = P(\text{will not get the flu} | \text{got a flu shot})$. The margin of error is $|p - \hat{p}|$.

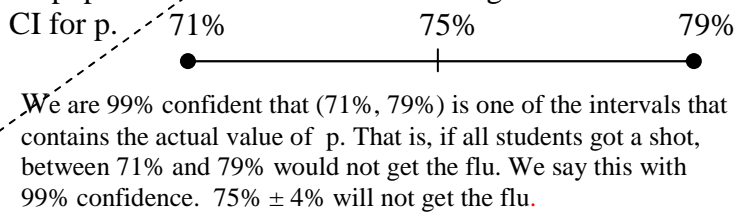
The Maximum Margin of Error E for a c level of confidence is $E = z_c \cdot \sqrt{\frac{\hat{p}\hat{q}}{n}}$

Page 426

A c Confidence Interval for p is $\hat{p} \pm z_c \sqrt{\frac{\hat{p}\hat{q}}{n}}$ if $n\hat{p} > 5$ and $n\hat{q} > 5$.

428, 5d A sample of size $n = 800$ students is taken from a population of 20000 students and given flu shots. Of the 800, 600 do not get the flu. Find a 99% CI for p .

STAT A



We are 99% confident that (71%, 79%) is one of the intervals that contains the actual value of p . That is, if all students got a shot, between 71% and 79% would not get the flu. We say this with 99% confidence. $75\% \pm 4\%$ will not get the flu.

429, 4 $n = 188, r = x = 66$. Find a 90% CI for p . **STAT** \downarrow A A 90% CI = (29%, 41%)

```

EDIT CALC TESTS
7:1-PropZInt...
8:TInterval...
9:2-SampZInt...
0:2-SampTInt...
1:1-PropZInt...
2:2-PropZInt...
3:kz-Test...

1-PropZInt
x:66
n:188
C-Level:.90
Calculate

1-PropZInt
(.29381,.40832)
p=.3510638298
n=188

```

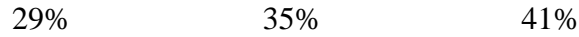
The margin of error is $.40832 - .35106$ is $5.7\% \approx 6\%$

```

1-PropZInt
(.29381,.40832)
p=.3510638298
n=188
.40832-.35106
.05726

p=.3510638298
n=188
.40832-.35106
.05726

```



35% of the books sold at a local bookstore are murder mysteries. This estimate has a margin of error of 6%. \leftarrow (often stated as $\pm 6\%$)

==== **Begin 8.4** =====

10 **The Sample Size n** for a cCI for μ with maximum error of estimate E is $n = \left(\frac{z_c \cdot s}{E} \right)^2$ rounded up.

The formula for n above is derived from $E = z_c \cdot \frac{s}{\sqrt{n}} \rightarrow E\sqrt{n} = z_c \cdot s \rightarrow \sqrt{n} = \frac{z_c \cdot s}{E} \leftarrow$ square each side

==== **Page 442, 2** Find the sample size n needed, to form a 90% CI for μ , for a maximum error of estimate $E = .5$.

After digging up at least 30 roots, s is found to be 8.94 in.

```

PRGM SAMPSIZE
c=.90
s=.94
E=.5
n=
865
Done

```

Conclusion: We need the root lengths of 865 plants in order to be 90% confident that the mean of the 865 measurements will be within .5 inches of μ , the mean of the population of root lengths in YNP.

IF, for example, \bar{x} of the 865 plants is 10 inches, then our 90%CI with $E = .5$, would be (9.5, 10.5) inches.

The formula method: For a 90% CI the $cv = z_c = 1.645$ found on the bottom row of the t-table under $c = .900$.

$$n = \left(\frac{z_c \cdot s}{E} \right)^2 = \left(\frac{1.645 \times 8.94}{.5} \right)^2 \approx 865.10 \text{ rounds up to } 866. \quad \text{Keys: } \boxed{1.645} \boxed{\times} \boxed{8.94} \boxed{\div} \boxed{.5} \boxed{)} \boxed{x^2} \boxed{\text{ENTER}}$$

Note: **PRGM SAMPSIZE** uses the exact value of z_c , 1.6449... getting 864.996 and rounding up to $n = 865$.

==== **Begin 8.5** =====

11 A way to tell if two populations x_1 and x_2 are different is to examine the difference in μ_1 and μ_2 i.e. $(\mu_1 - \mu_2)$ or the difference in p_1 and p_2 i.e. $(p_1 - p_2)$.

If both sides of a cCI for $(\mu_1 - \mu_2)$ are negative, then we are c confident $(\mu_1 - \mu_2) < 0 \rightarrow (\mu_1 < \mu_2)$.

If both sides of a cCI for $(\mu_1 - \mu_2)$ are positive, then we are c confident $(\mu_1 - \mu_2) > 0 \rightarrow (\mu_1 > \mu_2)$.

If a cCI for $(\mu_1 - \mu_2)$ has opposite signs, then we cannot say which mean is larger.

The same applies to all of the above if we replace μ with p .

A c CI for $(\mu_1 - \mu_2)$ when σ_1 and σ_2 are known is $(\bar{x}_1 - \bar{x}_2) \pm z_c \cdot \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$. Page 447

If n_1 and n_2 are both < 30 , then the populations must be normal to use this formula. A 2-Sample Z Interval.
If n_1 and n_2 are both > 29 , then the populations do not need to be normal.

448, 9 Populations x_1 and x_2 have $\sigma_1 = 1.9$ and $\sigma_2 = 2.3$. Find a 95% CI for $(\mu_1 - \mu_2)$. 1 \equiv before. 2 \equiv after.

Samples are drawn with $n_1 = 167$, $\bar{x}_1 = 5.2$ and $n_2 = 125$ and $\bar{x}_2 = 6.8$.

STAT 9

EDIT CALC TESTS	2-SampZInt	2-SampZInt	2-SampZInt
7:ZInterval...	Inpt:Data	Inpt:Data	Inpt:Data
8:TInterval...	$\sigma_1:1.9$	$\sigma_2:2.3$	$\sigma_1:1.9$
9:2-SampZInt...	$\sigma_2:2.3$	$x_1:5.2$	$x_1:5.2$
0:2-SampTInt...	$x_1:5.2$	$x_2:6.8$	$x_2:6.8$
A:1-PropZInt...	$n_1:167$	$n_1:167$	$n_1:167$
B:2-PropZInt...	$x_2:6.8$	$n_2:125$	$n_2:125$
C: χ^2 -Test...	$n_2:125$	C-Level:.95	
		Calculate	$(-2.096, -1.104)$

→ A 95% CI for $(\mu_1 - \mu_2) = (-2.1, -1.1)$.

Both sides of the CI are negative → we are 95% confident that $(\mu_1 < \mu_2)$ → $(\mu_2 > \mu_1)$

The mean number of fish caught/day μ_2 after the fire is greater than the mean number of fish caught/day μ_1 before the fire.

A c CI for $(\mu_1 - \mu_2)$ when σ_1 and σ_2 are unknown is found using (2-Samp TInt...).

Page 449.1.

450, 10 Populations x_1 and x_2 are normal and have unknown σ_1 and σ_2 . Find a 90% CI for $(\mu_1 - \mu_2)$.

Samples are drawn with $n_1 = 15$, $\bar{x}_1 = 19.65$, $s_1 = 1.86$ and $n_2 = 14$, $\bar{x}_2 = 6.59$, $s_2 = 1.91$

→ $\bar{x}_1 - \bar{x}_2 = 13.06$. 1 → wine

STAT 0

EDIT CALC TESTS	2-SampTInt	2-SampTInt	2-SampTInt	2-SampTInt
7:ZInterval...	Inpt:Data	Inpt:Data	Inpt:Data	Inpt:Data
8:TInterval...	$x_1:19.65$	$x_2:6.59$	$x_1:19.65$	$x_1:19.65$
9:2-SampZInt...	$s_1:1.86$	$s_2:1.91$	$s_1:1.86$	$s_2:1.91$
0:2-SampTInt...	$n_1:15$	$n_2:14$	$n_1:15$	$n_2:14$
A:1-PropZInt...	$x_2:6.59$	C-Level:.90	$x_2:6.59$	
B:2-PropZInt...	$s_2:1.91$	Pooled:No	$s_2:1.91$	
C: χ^2 -Test...	$n_2:14$	Calculate		
			$(11.866, 14.254)$	$(11.866, 14.254)$

A 90% CI for $(\mu_1 - \mu_2) = (11.9, 14.3)$.

μ_1 is the mean brain activity of people that drank 1/2 liter of wine before sleeping.

μ_2 is the mean brain activity of people that drank no wine before sleeping.

Both sides of the CI are positive → we are 90% confident that $(\mu_1 > \mu_2)$.

(The mean brain activity of the drinking group) is greater than (the mean brain activity non-drinking group).

A c CI for $(p_1 - p_2)$ for two independent binomial experiments is $(\hat{p}_1 - \hat{p}_2) \pm z_c \cdot \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}}$. Page 454

Where all of $n_1 \hat{p}_1$, $n_1 \hat{q}_1$, $n_2 \hat{p}_2$, $n_2 \hat{q}_2$, > 5 A 2-Proposition Z-Interval.

454, 11 Group 1 watched a comedy before sleep with $n_1 = 175$, and $r_1 = x_1 = 49$ had bad dreams.

Group 2 watched nothing before sleep with $n_2 = 180$, and $r_2 = x_2 = 63$ had bad dreams.

Find a 95% CI for $p_1 - p_2$.

STAT B

EDIT CALC TESTS	2-PropZInt	2-PropZInt
7:ZInterval...	$x_1:49$	$x_1:49$
8:TInterval...	$n_1:175$	$n_1:175$
9:2-SampZInt...	$x_2:63$	$x_2:63$
0:2-SampTInt...	$n_2:180$	$n_2:180$
A:1-PropZInt...	C-Level:.95	
B:2-PropZInt...	Calculate	$(-.1663, .02634)$
C: χ^2 -Test...		

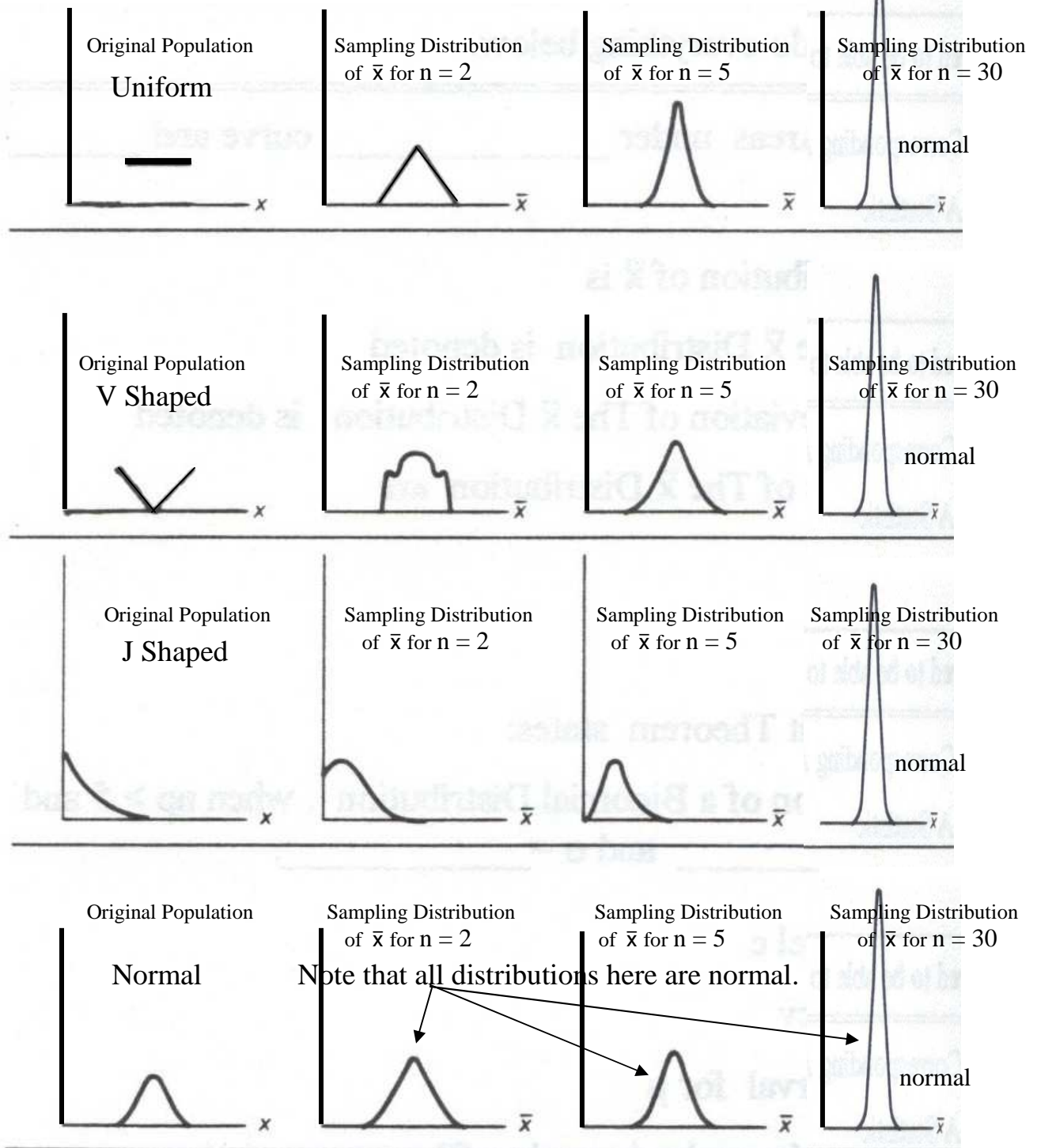
→ A 95% CI = (-17%, 3%).

Since the CI contains opposite signs, we cannot say that a comedy before sleep reduced bad dreams.

== End Block 3 ==

Sampling Distributions of \bar{x} for 4 Different Populations and 3 Sample Sizes

Note that as n becomes larger, the \bar{x} distributions tend to get closer to normal.



Here are the actual 18 test items as they will appear on Test L3.

Ten of these will be selected for the test but you are required to be able to do all of them.

The test item is in this font. *The answer is written in this font or in a box*

1 Complete: Corresponding Areas under a normal curve and the standard normal curve are equal.

2 Define: A Statistic *A Statistic is a number that is a descriptive measure of a sample.*

3 Complete: A sampling distribution of \bar{x} is
a probability distribution formed by all the means \bar{X} of all the samples, all of size n , from a population.

4 Complete: The Mean of The \bar{x} Distribution is denoted $\mu_{\bar{x}}$.

5 Complete: The Standard Deviation of The \bar{x} Distribution is denoted $\sigma_{\bar{x}}$.

6 Complete: Three Properties of The \bar{x} Distribution are

a) *If the population is normal, then the \bar{X} distribution is normal.*

b) $\mu_{\bar{x}} = \mu$. c) $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$.

7 Complete: The Central Limit Theorem states:

a) *The \bar{X} distribution from any population is usually normal when $n > 29$,*

b) $\mu_{\bar{x}} = \mu$. c) $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$.

1 Define: The Confidence Level c *The Confidence Level c is the reliability of the confidence interval.*

2 Define: The Critical Value cv

The Critical Value cv , denoted z_c or t_c , is the right boundary of the central area c .

3 Define: A c Confidence Interval for μ

A c Confidence Interval for μ is an interval cCI that is estimated to contain μ with a c level of confidence.

4 Complete: The cCI for μ when σ is given is $cCI = \left(\bar{x} \pm z_c \cdot \frac{\sigma}{\sqrt{n}} \right)$

5 Complete: The cCI for μ when σ is **not** given is $cCI = \left(\bar{x} \pm t_c \cdot \frac{s}{\sqrt{n}} \right)$

6 Complete: The Maximum Error E of Estimate of the cCI is $E = \boxed{cv \cdot \frac{SD}{\sqrt{n}}}$

7 Complete: 1) Student's t Distribution is used when $\boxed{\sigma \text{ is unknown}}$.

2) If $n < 30$, then *the population must be "normal" to use the t distribution.*

8 Complete: The Number of Degrees of Freedom for a t distribution is d.f. = $\boxed{n - 1}$.

9 Complete: The Point Estimate \hat{p} for p in a binomial experiment with n trials and r successes is $\boxed{\hat{p} = \frac{r}{n} = \frac{x}{n}}$

10 Complete: The sample size n for a cCI with maximum error E is $n = \boxed{\left(\frac{z_c \cdot s}{E}\right)^2}$ rounded up

11 To tell if two populations x_1 and x_2 are different, examine the difference in μ_1 and μ_2 i.e. $(\mu_1 - \mu_2)$ or the difference in p_1 and p_2 i.e. $(p_1 - p_2)$

If both sides of a cCI for $(\mu_1 - \mu_2)$ are negative, then we are c confident that $\boxed{\mu_1 < \mu_2}$.

If both sides of a cCI for $(\mu_1 - \mu_2)$ are positive, then we are c confident that $\boxed{\mu_1 > \mu_2}$.

If a cCI for $(\mu_1 - \mu_2)$ has opposite signs, then *we cannot say which mean is larger.*

You are required to be able to do everything below.

1 Complete: Corresponding Areas under _____ curve and _____ curve are equal.

2 Define: A Statistic

3 Complete: A sampling distribution of \bar{x} is

4 Complete: The Mean of The \bar{x} Distribution is denoted

5 Complete: The Standard Deviation of The \bar{x} Distribution is denoted

6 Complete: Three Properties of The \bar{x} Distribution are

a)

b)

c)

7 Complete: The Central Limit Theorem states:

1 Define: The Confidence Level c

2 Define: The Critical Value cv

3 Define: A c Confidence Interval for μ

4 Complete: The c CI for μ when σ is given is c CI =

5 Complete: The c CI for μ when σ is **not** given is c CI =

6 Complete: The Maximum Error E of Estimate of the c CI is $E =$

7 Complete: 1) Student's t Distribution is used when

2) If $n < 30$, then

8 Complete: The Number of Degrees of Freedom for a t distribution is $d.f. =$

9 Complete: The Point Estimate \hat{p} for p in a binomial experiment with n trials and r successes is

10 Complete: The sample size n for a c CI with maximum error E is $n =$

11 To tell if two populations x_1 and x_2 are different, examine the difference in μ_1 and μ_2 i.e. $(\mu_1 - \mu_2)$
or the difference in p_1 and p_2 i.e. $(p_1 - p_2)$

If both sides of a c CI for $(\mu_1 - \mu_2)$ are negative, then we are c confident that ...

If both sides of a c CI for $(\mu_1 - \mu_2)$ are positive, then we are c confident that ...

If a c CI for $(\mu_1 - \mu_2)$ has opposite signs, then ...

6.3

330, 1 **PRGM** **NORMAL**

<pre> NORMAL DISTR 1:Z M=0, S=1 2:Z n=1 3:Z n>1 </pre>	<pre> MU=?4 σx=?2 </pre>	<pre> 1:PROBABILITY 2:BOUNDARY </pre>	<pre> 1:P(X<R) L.area 2:P(X>L) r.area 3:P(L<X<R) </pre>	<pre> MU=?4 σx=?2 FIND P(L<X<R) L=?3 Z=?1.5 R=?6 Z=?1 PROB=.532807 </pre>	<pre> 1:GRAPH 2:Stop </pre>	
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Note: In a continuous distribution $P(3 < x < 6) = P(3 \leq x \leq 6)$. $P(3 < x < 6) \approx 53\%$

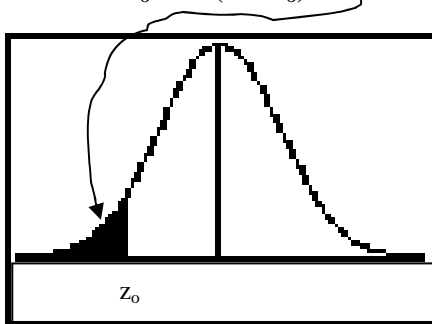
330, 9 **PRGM** **NORMAL**

$P(x > 90) \approx 75\%$

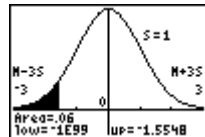
<pre> NORMAL DISTR 1:Z M=0, S=1 2:Z n=1 3:Z n>1 </pre>	<pre> MU=?100 σx=?15 </pre>	<pre> 1:PROBABILITY 2:BOUNDARY </pre>	<pre> 1:P(X<R) L.area 2:P(X>L) r.area 3:P(L<X<R) </pre>	<pre> MU=?100 σx=?15 FIND P(X>L) L=?90 Z=?-1.6667 PROB=.747508 </pre>	<pre> 1:GRAPH 2:Stop </pre>	
---	---	---	---	--	---	--

330, 11 Find z_0 so $P(z < z_0) = .06$.

PRGM **NORMAL**



<pre> NORMAL DISTR 1:Z M=0, S=1 2:Z n=1 3:Z n>1 </pre>	<pre> 1:PROBABILITY 2:BOUNDARY </pre>	<pre> 1:LEFT AREA 2:RIGHT AREA 3:CENTRAL AREA </pre>	<pre> AREA=? .06 Z=?-1.55477 BOUNDARY=?-1.55477 </pre>
---	---	--	--



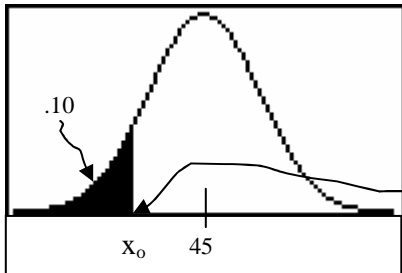
z

$z_0 \approx -1.555$ $P(z < -1.555) \approx .06$

331, 19 **PRGM** **NORMAL**

<pre> NORMAL DISTR 1:Z M=0, S=1 2:Z n=1 3:Z n>1 </pre>	<pre> 1:PROBABILITY 2:BOUNDARY </pre>	<pre> 1:LEFT AREA 2:RIGHT AREA 3:CENTRAL AREA </pre>	<pre> AREA=? .98 Z=?-2.32635 BOUNDARY=?-2.32635 </pre>	<pre> 1:GRAPH 2:Stop </pre>	
---	---	--	--	---	--

332, 29b



<pre> PRGM NORMAL 2 MU=?45 σx=?10 </pre>	<pre> 1:PROBABILITY 2:BOUNDARY </pre>	<pre> 1:LEFT AREA 2:RIGHT AREA 3:CENTRAL AREA </pre>	<pre> AREA=? .10 Z=?-1.28155 BOUNDARY=?34.74759 </pre>
--	---	--	--

If the batteries are guaranteed for 35 months, the company will only have to replace about 10.6% of them.

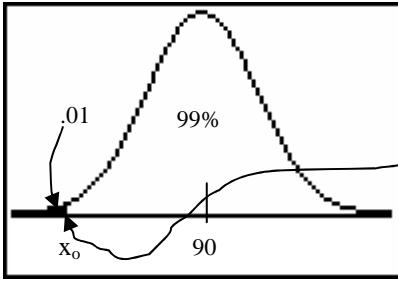
333, 31 **PRGM** **NORMAL 2**

<pre> MU=?8 σx=?1.5 FIND P(X>L) L=?75 Z=?-2 PROB=.97725 </pre>	<pre> MU=?8 σx=?1.5 FIND P(X<R) R=?10 Z=?1.3333 PROB=.908789 </pre>
---	--

334, 33

<pre> (70-22)/4 12 </pre>	<pre> MU=?46 σx=?12 FIND P(X<R) R=?25 Z=?-1.75 PROB=.040059 </pre>	<pre> MU=?46 σx=?12 FIND P(X>L) L=?60 Z=?1.1667 PROB=.121673 </pre>	<pre> MU=?46 σx=?12 FIND P(L<X<R) L=?25 R=?60 Z=?-1.75 Z=?1.167 PROB=.838268 </pre>	<pre> 1:LEFT AREA 2:RIGHT AREA 3:CENTRAL AREA </pre>	<pre> AREA=? .10 Z=?1.28155 BOUNDARY=?61.37862 </pre>
---	---	--	---	--	---

334, 35a



PRGM NORMAL 2

MU=?90
σx=?3.7

1: PROBABILITY
2: BOUNDARY

KNOWN
1: LEFT AREA
2: RIGHT AREA
3: CENTRAL AREA

AREA=? .01
Z=-2.32635
BOUNDARY=
81.39251

Guarantee a chip for 81 months and there is a 99% probability that it will last beyond the guarantee period.

b PRGM NORMAL

NORMAL TYPE
1: Z M=0, S=1
2: X n=1
3: X n>1

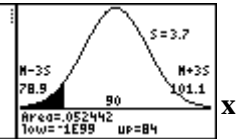
MU=?90
σx=?3.7

1: PROBABILITY
2: BOUNDARY

1: P(X<R) L.area
2: P(X>L) r.area
3: P(L<X<R)

MU=?90
σx=?3.7
FIND P(X<R)
R=?84
Z=-1.6216
PROB=.052442

SECON
1: GRAPH
2: Stop



Guarantee the chip for 84 months and there is a 5% probability that it will malfunction in the guarantee period.

334, 35 (c) $\$50,000,000 \times .0524422 = \$2,622,110$ is the expected loss to the company.

334, 35 (d) Profit = $3,000,000 - 2,622,110 = \$377,890$. (The books answer is the result of rounding.)

$$335,39a \ P(x > 20 | x > 15) = \frac{P((x > 20 \text{ and } (x > 15)))}{P(x > 15)} = \frac{P(x > 20)}{P(x > 15)} \rightarrow \text{see below} \rightarrow \frac{.308538}{.773373} \approx .4 = 40\%$$

NORMAL TYPE
1: Z M=0, S=1
2: X n=1
3: X n>1

MU=?18
σx=?4

1: PROBABILITY
2: BOUNDARY

1: P(X<R) L.area
2: P(X>L) r.area
3: P(L<X<R)

MU=?18
σx=?4
FIND P(X>L)
L=?20
Z=.5
PROB=.308538

MU=?18
σx=?4
FIND P(X>L)
L=?15
Z=-.75
PROB=.773373

7.2

373, 1a PRGM NORMAL

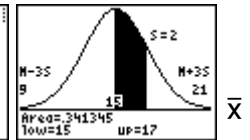
NORMAL TYPE
1: Z M=0, S=1
2: X n=1
3: X n>1

MU=?15
σx=?14
n=?49

1: PROBABILITY
2: BOUNDARY

1: P(X<R) L.area
2: P(X>L) r.area
3: P(L<X<R)

MU=?15
σx=?14
n=?49
SE MEAN=2
P(L<X<R)
L=?15 Z=0
R=?17 Z=1
PROB=.341345

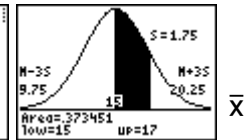


b

MU=?15
σx=?14
n=?64

$P(15 < \bar{X} < 17) \approx 34\%$

MU=?15
σx=?14
n=?64
SE MEAN=1.75
P(L<X<R)
L=?15 Z=0
R=?17 Z=1.143
PROB=.373451



c In the (a) distribution, 15 and 17 have z-scores of 0 and 1.

In the (b) distribution, 15 and 17 have z-scores of 0 and 1.14. There is more area between 0 and 1.14.

$\sigma_{\bar{x}} = 1.75$ in b and is smaller than $\sigma_{\bar{x}} = 2$ in a. b has a narrower distribution, so the area between 15 and 17 is bigger.

375, 11

x is the **monthly percent return** of the mutual fund. The fund has stocks from 250 companies.

This is a large sample of all of the companies in the world. Because x is a large sample of averages, it is an \bar{X} distribution that is normal. For x, $\mu = 1.6$ and $\sigma = .9$. (Both are percents.)

(b) $n = 6$. This sample is small, $n = 6$, but it is from a normal distribution so its distribution \bar{X} is normal.

PRGM NORMAL

NORMAL TYPE
1: Z M=0, S=1
2: X n=1
3: X n>1

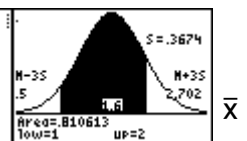
MU=?1.6
σx=?2.9
n=?6

1: PROBABILITY
2: BOUNDARY

1: P(X<R) L.area
2: P(X>L) r.area
3: P(L<X<R)

MU=?1.6
σx=?2.9
n=?6
SE MEAN=.3674
P(L<X<R)
L=?1 Z=-1.633
R=?2 Z=1.089
PROB=.810613

SECON
1: GRAPH
2: Stop



(c) is done like (b) except $n = 24$.

$P(1 < \bar{X} < 2) = 81\%$

376, 13 b **PRGM** **NORMAL**

NORMAL TYPE 1:Z M=0, S=1 2:X n=1 SE X n>1	MU=?10.8 σx=?4.9 n=?5	PROBABILITY 2:BOUNDARY	PROBABILITY 1:P(X<R) L.area 2:P(X>L) r.area 3:P(L<X<R)	MU=?10.8 σx=?4.9 n=?5 SE MEAN=2.1913 FIND P(X<R) R=?6 Z=-2.1904 PROB=.014246
---	-----------------------------	----------------------------------	--	---

$$P(\bar{X} < 6\%) = .014$$

With a probability this small, it is unlikely that the mean was really 10.8%. The market is weaker than 10.8%.

PRGM **NORMAL**

NORMAL TYPE 1:Z M=0, S=1 2:X n=1 SE X n>1	MU=?10.8 σx=?4.9 n=?5	PROBABILITY 2:BOUNDARY	PROBABILITY 1:P(X<R) L.area 2:P(X>L) r.area 3:P(L<X<R)	MU=?10.8 σx=?4.9 n=?5 SE MEAN=2.1913 P(X>L) L=?16 Z=-2.373 PROB=.008823
---	-----------------------------	----------------------------------	--	--

$$P(\bar{X} > 16\%) = .009$$

It is very unlikely that the mean was really 10.8%. The market is heating up and the yield is more than 10.8%.

378, 19 (a) If the total weight w of 45 m^3 is 9500g , then the average weight \bar{x} of 1 m^3 is $\frac{9500}{45} \approx 211$.

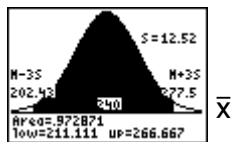
PRGM **NORMAL**

NORMAL TYPE 1:Z M=0, S=1 2:X n=1 SE X n>1	MU=?240 σx=?84 n=?45	PROBABILITY 2:BOUNDARY	PROBABILITY 1:P(X<R) L.area 2:P(X>L) r.area 3:P(L<X<R)	MU=?240 σx=?84 n=?45 SE MEAN=12.522 FIND P(X<R) R=?9500/45 Z=-2.3071 PROB=.010526	GRAPH 2:Stop	
---	----------------------------	----------------------------------	--	--	------------------------	--

$$P(w < 9500) = P\left(\bar{x} < \frac{9500}{45}\right) \approx .011$$

(c) **PRGM** **NORMAL**

NORMAL TYPE 1:Z M=0, S=1 2:X n=1 SE X n>1	MU=?240 σx=?84 n=?45	PROBABILITY 2:BOUNDARY	PROBABILITY 1:P(X<R) L.area 2:P(X>L) r.area 3:P(L<X<R)	MU=?240 σx=?84 n=?45 SE MEAN=12.522 FIND P(X<R) L=?9500/45 R=?12000/45 Z=-2.3071 PROB=.972871	GRAPH 2:Stop
---	----------------------------	----------------------------------	--	---	------------------------



$$P(9500 < w < 12000) = P\left(\frac{9500}{45} < \bar{x} < \frac{12000}{45}\right) \approx 97\%$$

378, 21 (a) If the total distance d in 5 years is 90 ft , then the average distance \bar{d} in 1 year is $\frac{90}{5} = 18 \text{ ft}$.

(b) If the total distance d in 5 years is 80 ft , then the average distance \bar{d} in 1 year is $\frac{80}{5} = 16 \text{ ft}$.

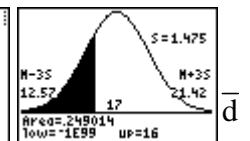
a $P(d > 90) = P(\bar{d} > 18) \approx 25\%$

b $P(d < 80) = P(\bar{d} < 16) \approx 25\%$

NORMAL TYPE 1:Z M=0, S=1 2:X n=1 SE X n>1	MU=?17 σx=?3.3 n=?5 SE MEAN=1.4758 P(X>L) L=?90/5 Z=-.6776 PROB=.249014
---	--

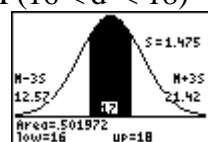
the book rounds z to .68

MU=?17 σx=?3.3 n=?5 SE MEAN=1.4758 FIND P(X<R) R=?16 Z=-.6776 PROB=.249014



c $P(80 < d < 90) = P(16 < \bar{d} < 18) \approx 50\%$

MU=?17 σx=?3.3 n=?5 SE MEAN=1.4758 P(L<X<R) L=?16 Z=-.678 R=?18 Z=.678 PROB=.501972
--



8.1

408, 1 [STAT] 7 σ is known, so a ZInterval is correct.

ZInterval Inpt:Data STAT σ : 3.3 \bar{x} : 3.15 n : 15 C-Level: .80 Calculate	ZInterval (3.0408, 3.2592) \bar{x} : 3.15 n : 15	\bar{x} : 3.15 n : 15 3.2592 - 3.15 .1092
---	---	--

408, 3 [STAT] 7

ZInterval Inpt:Data STAT σ : 7.5 \bar{x} : 37.5 n : 45 C-Level: .99 Calculate	ZInterval (34.62, 40.38) \bar{x} : 37.5 n : 45	\bar{x} : 37.5 n : 45 40.38 - 37.5 2.88
---	---	--

409, 5 [STAT] 7

ZInterval Inpt:Data STAT σ : 42.6 \bar{x} : 138.5 n : 30 C-Level: .9 Calculate	ZInterval (125.71, 151.29) \bar{x} : 138.5 n : 30	\bar{x} : 138.5 n : 30 151.29 - 138.5 12.79
--	--	--

ZInterval Inpt:Data STAT σ : 42.6 \bar{x} : 138.5 n : 30 C-Level: .95 Calculate	ZInterval (123.26, 153.74) \bar{x} : 138.5 n : 30	\bar{x} : 138.5 n : 30 153.74 - 138.5 15.24
---	--	--

ZInterval Inpt:Data STAT σ : 42.6 \bar{x} : 138.5 n : 30 C-Level: .99 Calculate	ZInterval (118.47, 158.53) \bar{x} : 138.5 n : 30	\bar{x} : 138.5 n : 30 158.53 - 138.5 20.03
---	--	--

410, 7 [STAT] 7

ZInterval Inpt:Data STAT σ : 18490 \bar{x} : 58940 n : 36 C-Level: .90 Calculate	ZInterval (53871, 64009) \bar{x} : 58940 n : 36	\bar{x} : 58940 n : 36 64009 - 58940 5069
--	--	--

ZInterval Inpt:Data STAT σ : 18490 \bar{x} : 58940 n : 64 C-Level: .9 Calculate	ZInterval (55138, 62742) \bar{x} : 58940 n : 64	\bar{x} : 58940 n : 64 62742 - 58940 3802
---	--	--

ZInterval Inpt:Data STAT σ : 18490 \bar{x} : 58940 n : 121 C-Level: .9 Calculate	ZInterval (56175, 61705) \bar{x} : 58940 n : 121	\bar{x} : 58940 n : 121 61705 - 58940 2765
--	---	---

410, 9 a Enter data into L1 b [STAT] 7

L1	L2	L3	1
33			
30.9			
33.1			
33.3			
33.8			
33.8			
33.9			
34.0			
34.1			
34.2			
34.3			
34.4			
34.5			
34.6			
34.7			
34.8			
34.9			
35.0			
35.1			
35.2			
35.3			
35.4			
35.5			
35.6			
35.7			
35.8			
35.9			
36.0			
36.1			
36.2			
36.3			
36.4			
36.5			
36.6			
36.7			
36.8			
36.9			
37.0			
37.1			
37.2			
37.3			
37.4			
37.5			
37.6			
37.7			
37.8			
37.9			
38.0			
38.1			
38.2			
38.3			
38.4			
38.5			
38.6			
38.7			
38.8			
38.9			
39.0			
39.1			
39.2			
39.3			
39.4			
39.5			
39.6			
39.7			
39.8			
39.9			
40.0			
40.1			
40.2			
40.3			
40.4			
40.5			
40.6			
40.7			
40.8			
40.9			
41.0			
41.1			
41.2			
41.3			
41.4			
41.5			
41.6			
41.7			
41.8			
41.9			
42.0			
42.1			
42.2			
42.3			
42.4			
42.5			
42.6			
42.7			
42.8			
42.9			
43.0			
43.1			
43.2			
43.3			
43.4			
43.5			
43.6			
43.7			
43.8			
43.9			
44.0			
44.1			
44.2			
44.3			
44.4			
44.5			
44.6			
44.7			
44.8			
44.9			
45.0			

ZInterval Inpt: STAT Stats σ : 10.2 List: L1 Freq: 1 C-Level: .75 Calculate	ZInterval (34.185, 37.806) \bar{x} : 35.9952381 Sx : 10.23785306 n : 42
---	---

ZInterval Inpt: STAT Stats σ : 10.2 List: L1 Freq: 1 C-Level: .9 Calculate	ZInterval (33.406, 38.584) \bar{x} : 35.9952381 Sx : 10.23785306 n : 42
--	---


411, 11c [STAT] 7

ZInterval Inpt:Data STAT σ : 3.04 \bar{x} : 51.16 n : 40 C-Level: .99 Calculate	ZInterval (49.922, 52.398) \bar{x} : 51.16 n : 40
---	--

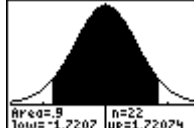
99% CI = (49.92, 52.40)

8.2

420, 1 [PRGM] cv

KNOWIN 1: C CENTRAL AREA 2: A' 1-TAIL 3: A'' 2-TAIL	c = ? .95	INVT 1: C 2: 2	c = ? .95 n = ? 18 df = CV t = 2.10982	
--	-----------	----------------------	--	--

420, 3 [PRGM] cv

KNOWIN 1: C CENTRAL AREA 2: A' 1-TAIL 3: A'' 2-TAIL	c = ? .90	INVT 1: C 2: 2	c = ? .90 n = ? 22 df = CV t = 1.72074	
--	-----------	----------------------	--	--

420, 5 Enter the 9 data values into L1. **STAT** \leftarrow 8 σ is unknown, so a t interval is correct.

L1	L2	L3	1	TInterval	TInterval
1272				Inpt: DATA Stats	(1249.3, 1295.1)
1268				List: L1	$\bar{x}=1272.222222$
1216				Freq: 1	$Sx=36.9282337$
1275				C-Level: .90	n=9
1217				Calculate	
1275					
1275					
L1(10) =					

420, 7

L1	L2	L3	1	TInterval	TInterval
68				Inpt: DATA Stats	(74.685, 107.31)
104				List: L1	$\bar{x}=91$
128				Freq: 1	$Sx=30.71807286$
12				C-Level: .75	n=6
60				Calculate	
64					
L1(7) =					

421, 9

TInterval	TInterval
Inpt: Data Stats	(76.039, 82.461)
$\bar{x}=79.25$	$\bar{x}=79.25$
$Sx=5.33$	$Sx=5.33$
n=6	n=6
C-Level: .8	
Calculate	

421, 11 b c

TInterval	TInterval
Inpt: Data Stats	(8.4079, 11.492)
$\bar{x}=9.95$	$\bar{x}=9.95$
$Sx=1.02$	$Sx=1.02$
n=10	n=10
C-Level: .999	
Calculate	

8.3

433, 1 **STAT** \leftarrow A

1-PropZInt
x: 39
n: 62
C-Level: .95
Calculate

1-PropZInt
(.50879, .74927)
$\hat{p}=.6290322581$
n=62

433, 3 **STAT** \leftarrow A

1-PropZInt
x: 1619
n: 5222
C-Level: .99
Calculate

1-PropZInt
(.29355, .32652)
$\hat{p}=.3100344696$
n=5222

434, 5 **STAT** \leftarrow A

1-PropZInt
x: 3139
n: 5792
C-Level: .99
Calculate

1-PropZInt
(.52509, .55882)
$\hat{p}=.5419544199$
n=5792

435, 15 **STAT** \leftarrow A

1-PropZInt
x: 628
n: 730
C-Level: .95
Calculate

1-PropZInt
(.83512, .88542)
$\hat{p}=.8602739726$
n=730

$\hat{p}=.8602739726$
n=730
.88542-.86027
.02515

436, 17 **STAT** \leftarrow A

1-PropZInt
x: 250
n: 1000
C-Level: .95
Calculate

1-PropZInt
(.22316, .27684)
$\hat{p}=.25$
n=1000

$\hat{p}=.25$
n=1000
.27684-.25
.02684

8.4

442, 1 **PRGM** **SAMPsize**

c=? .95	
S=? 44	
E=? 10	
n=	75
	Done

442, 5 $n_1 = 56 \rightarrow s = 26.58$

PRGM **SAMPsize**

c=? .90	
S=? 26.58	
E=? 4	
n=	120
	Done

$120 - 56 = 64$

We need 64 more weights to be 90% confident that the average weight of the 120 players will be within 4 pounds of the actual average of all of the players.

444, 15 $n_1 = 167 \rightarrow s = 3.8$. $E = .5$ (30 seconds = .5 minutes)

PRGM **SAMPsize**

c=? .99	
S=? 3.8	
E=? .5	
n=	384
	Done

$384 - 167 = 217$.

Get 217 more customers to be 99% confident that the mean of the 384 times will be no more than 30 seconds from the true mean.

8.5

457, 1 Enter data into L1 and L2 **STAT** \leftarrow 0

L1	L2	L3	2
870	740		
720	890		
-----	520		
	650		
	680		
	880		
	980		

	880		

	880		

```
2-SampTInt
Inpt: Stats
List1:L1
List2:L2
Freq1:1
Freq2:1
C-Level: .9
Pooled: Yes
```

```
2-SampTInt
(-114.8, 131.97)
df=25.83591823
x1=747.5
x2=738.9375
s1=170.407266
s2=212.146323
```

```
2-SampTInt
(-114.8, 131.97)
z=738.9375
x1=170.407266
x2=212.146323
n1=12
n2=16
```

← The TI gives better results.

The CI for $(\mu_1 - \mu_2)$ has opposite signs, so we cannot say with 90% confidence which mean is larger.

458, 3 b **STAT** \leftarrow 0

```
2-SampTInt
Inpt: Data
x1:51.66
s1:7.93
n1:16
x2:33.6
s2:12.26
n2:17
```

```
2-SampTInt
n1:16
x2:33.6
s2:12.26
n2:17
C-Level: .85
Pooled: Yes
Calculate
```

```
2-SampTInt
(12.768, 23.352)
df=27.57438451
x1=51.66
x2=33.6
s1=7.93
s2=12.26
```

```
2-SampTInt
(12.768, 23.352)
z=33.6
x1=7.93
x2=12.26
n1=16
n2=17
```

← The TI gives better results.

Both sides of the CI for $(\mu_1 - \mu_2)$ are positive. We are 85% confident that $(\mu_1 > \mu_2)$.

459, 5 b **STAT** \leftarrow 0

```
2-SampTInt
Inpt: Data
x1:6.173
s1:1.366
n1:45
x2:6.453
s2:1.314
n2:40
```

```
2-SampTInt
n1:45
x2:6.453
s2:1.314
n2:40
C-Level: .90
Pooled: Yes
Calculate
```

```
2-SampTInt
(-.3967, -.1513)
df=82.90477865
x1=6.173
x2=6.453
s1=1.366
s2=1.314
```

```
2-SampTInt
(-.3967, -.1513)
z=6.453
x1=1.366
x2=1.314
n1=45
n2=40
```

← The TI gives better results.

Both sides of the CI for $(\mu_1 - \mu_2)$ are negative. We are 90% confident that $(\mu_1 < \mu_2)$.

460, 7 **STAT** \leftarrow **B**

```
2-PropZInt
x1:299
n1:375
x2:53
n2:571
C-Level: .99
Calculate
```

```
2-PropZInt
(.69058, .79019)
p1=.770666667
p2=.092802102
n1=375
n2=571
```

461, 11 **STAT** \leftarrow **B**

```
2-PropZInt
x1:65
n1:210
x2:18
n2:152
C-Level: .99
Calculate
```

```
2-PropZInt
(.08476, .29745)
p1=.3095238095
p2=.1184210526
n1=210
n2=152
```

Both sides of the CI for $(p_1 - p_2)$ are positive. We are 99% confident that $(p_1 > p_2)$.