5	A	*1. Calculated z-value → p-value … 1-tailed & 2-tailed

a) If the **calculated z** for an experiment equals **1.35**, what is the corresponding **p-value**?

1-tail: p = ________ 2-tail: p = ________

b) If the **calculated z** for an experiment equals **- 0.7**, what is the corresponding **p-value**?

1-tail: p = ________ 2-tail: p = ________

c) If the **calculated z** for an experiment equals **2.2**, what is the corresponding **p-value**?

1-tail: p = ________ 2-tail: p = ________

5	A	2. alpha → critical z-value … 1-tailed & 2-tailed

a) If **alpha** were set to the unusual value of **.08**, what would be the magnitude of the **critical z**?

1-tail: z_{cv} = ________ 2-tail: z_{cv} = ________

b) If **alpha** were set to the unusual value of **.03**, what would be the magnitude of the **critical z**?

1-tail: z_{cv} = ________ 2-tail: z_{cv} = ________

c) If **alpha** were set to the unusual value of **.007**, what would be the magnitude of the **critical z**?

1-tail: z_{cv} = ________ 2-tail: z_{cv} = ________

5	A	*5. sample mean → p-value (2-tailed)

An English professor suspects that her current class **of 36 students** is unusually good at verbal skills. She looks up the verbal SAT score for each student and is pleased to find that the **mean for the class is 540**.

Assuming that the general population of students has a **mean verbal SAT score of 500** with a **standard deviation of 100**, what is the **two-tailed** p value corresponding to this class?

POPULATION PARAMETERS

μ = ________

σ = ________

n = ________

SAMPLE STATISTICS

$\bar{X}$ = ________

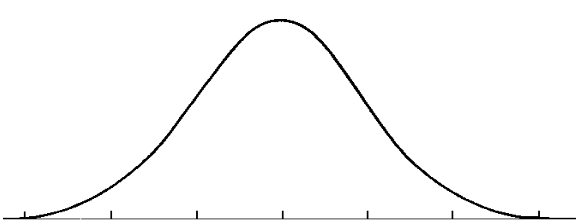
$\sigma_{\bar{X}}$ = ________

Standard Error for the Mean

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$$

Formula 5.1

$$z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$$



z = __________

2-tail: p = __________

5	A	6. Very large z-score

Consider a situation in which you have **calculated the z score** for a group of participants and have obtained the unusually high value of **20**.

Which of the following statements would be **true**, and which would be **false**?
Explain your answer in each case.

a.) You must have made a calculation error because z scores cannot get so high.

☐ TRUE ☐ FALSE **EXPLAIN**.

b.) The null hypothesis cannot be true.

☐ TRUE ☐ FALSE **EXPLAIN**.

c.) The null hypothesis can be rejected, even if a very small alpha is used.

☐ TRUE ☐ FALSE **EXPLAIN**.

d.) The difference between the sample mean and the hypothesized population mean must have been quite large.

☐ TRUE ☐ FALSE **EXPLAIN**.

5	A	7. Very large z-score

Suppose the z score mentioned in Exercise 6 involved the measurement of height for a group of men. If **μ = 69 inches** and **σ = 3 inches**, **how** can a group of men have a **z score equal to 20**?

Give a **numerical example** illustrating how this can occur.

5	A	9. One-tail vs. Two-tails

Describe a situation in which a **one-tailed** hypothesis test seems justified.

Describe a situation in which a **two-tailed** test is clearly called for.

5	A	10. One-tail vs. Two-tails

Describe a case in which it would probably be appropriate to use an **alpha smaller** than the conventional .05 (e.g., .01).

Describe a case in which it might be appropriate to use an unusually **large alpha** (e.g., .1).

5	B	*1. Hypothesis test: Mean (z-score)

A psychiatrist is testing a new antianxiety drug, which seems to have the potentially harmful side effect of lowering the heart rate. For a **sample of 50** medical students whose pulse was measured after 6 weeks of taking the drug, the **mean heart rate was 70 beats per minute** (bpm).

If the mean heart rate for the **population** is **72 bpm** with a **standard deviation of 12**, can the psychiatrist conclude that the new drug lowers heart rate significantly? (Set alpha = .05 and perform a one-tailed test.)

POPULATION PARAMETERS

μ = _______

σ = _______

n = _______

SAMPLE STATISTICS

$\bar{X}$ = _______

$\sigma_{\bar{X}}$ = _______

H₀ : _________

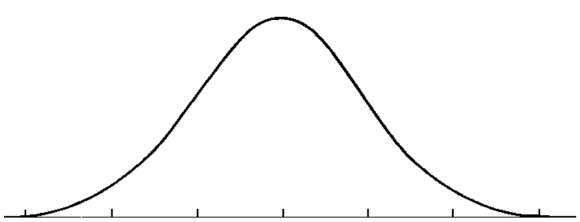
Hₐ : _________

Standard Error for the Mean

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$$

Formula 5.1

$$z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$$



z = _________

1-tail: p = _________

☐ *Provides evidence that new drug lowers heart rate*

☐ *No evidence that the new drug lowers heart rate*

5	B	*8. sample mean → p-value (2-tailed)

Imagine that you are testing a new drug that seems to <u>**raise**</u> the number of T cells in the blood and therefore has enormous potential for the treatment of disease. After treating **100 patients**, you find that their **mean T cell count is 29.1**. Assume that **μ and σ (hypothetically) are 28 and 6**, respectively.

POPULATION PARAMETERS

μ = ______

σ = ______

n = ______

SAMPLE STATISTICS

$\bar{X}$ = ______

$\sigma_{\bar{X}}$ = ______

H₀ : __________

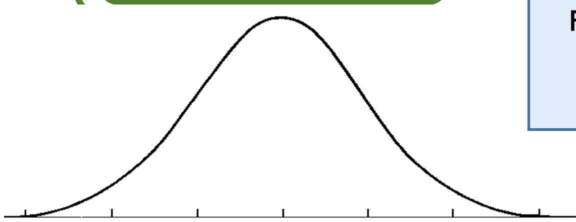
Hₐ : __________

Standard Error for the Mean

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$$

Formula 5.1

$$z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$$



z = __________

2-tail: p = __________

a.) Test the null hypothesis at the **.05 level, two-tailed.**

☐ *Provides evidence that new drug increases T cells*
☐ *No evidence that the new drug increases T cells*

b.) Test the same hypothesis at the **.10 level, two-tailed**.

☐ *Provides evidence that new drug increases T cells*
☐ *No evidence that the new drug increases T cells*

c.) **Describe** in practical terms what it would mean to **commit a Type I error** in this example.

d.) **Describe** in practical terms what it would mean to **commit a Type II error** in this example.

e.) How might you **justify** the use of .10 for alpha in similar experiments?

5	B	9. Effect of the Population SD on the z-score

a) Assuming everything else in the previous problem stayed the same, what would happen to your **calculated z** if the **population standard deviation (σ) were 3 instead of 6**?

Standard Error for the Mean
$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$$

Formula 5.1
$$z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$$

z = __________ → __________

b) What **general statement** can you make about how changes in σ affect the calculated value of z ?

5	B	*10. Sample size requirements

Referring to Exercise 8, suppose that **mean ($\bar{X}$) is equal to 29.1** *regardless of the sample size*.

How large would n have to be for the calculated z to be statistically significant at the **.01 level (two-tailed)?**

Formula 5.1
$$z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$$

n = __________

5	B	11. Define 'alpha'

Alpha stands for which of the following?

a) The proportion of experiments that will attain statistical significance ☐ TRUE

b) The proportion of experiments for which the null hypothesis is true that will attain statistical significance ☐ TRUE

c) The proportion of statistically significant results for which the null hypothesis is true ☐ TRUE

d) The proportion of experiments for which the null hypothesis is true ☐ TRUE

5	B	12. Errors in hypothesis testing

In the last few years, an organization has conducted **200 clinical trials** to test the effectiveness of antianxiety drugs.

Suppose, however, that **all** of those drugs were obtained from the same **fraudulent** supplier, which was later revealed to have been sending only inert substances (e.g., distilled water, sugar pills) instead of real drugs. If **alpha = .05** was used for all hypothesis tests…

How many **of these 200** experiments would you expect to **yield significant** results? ☐

How many **Type I errors** would you expect? ☐

How many **Type II errors** would you expect? ☐

5	B	13. Errors in hypothesis testing

Since she arrived at the university, Dr. Pine has been very productive and successful. She has already performed **20 experiments** that have **each** attained the **.05** level of statistical significance.

What is your best guess for the number of **Type I errors** she has made so far? ☐

For the number of **Type II errors**? ☐

5	C	3. Hypothesis test: Mean (z-score)

a) **In the past** 10 years, previous stats classes who took the same **mathquiz** that Ihno's students took **averaged 28** with a **standard deviation of 8.5**. What is the **two-tailed p value** for Ihno's students with respect to that past population? *(Don't forget that the N for mathquiz is not 100.)*

write code to find mean & n in your R syntax file

POPULATION PARAMETERS

μ = ______

σ = ______

n = ______

SAMPLE STATISTICS

$\bar{X}$ = ______

$\sigma_{\bar{X}}$ = ______

H_0 : __________

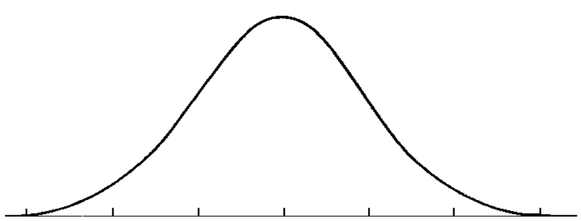
H_a : __________

Standard Error for the Mean

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$$

Formula 5.1

$$z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$$



z = __________

2-tail: p = __________

Would you say that Ihno's class performed **significantly better** than previous classes?

☐ ***Provides evidence*** *Ihno's class performed* ***significantly better*** *than previous classes*

☐ ***No evidence*** *that Ihno's class performed any differently than previous classes*

EXPLAIN.

5	C	3. Hypothesis test: Mean (z-score)

b) **In the past** 10 years, previous stats classes who took the same **statquiz** that Ihno's students took **averaged 6.1** with a s**tandard deviation of 2.5**. What is the **two-tailed p value** for Ihno's students with respect to that past population?

write code to find mean & n in your R syntax file

POPULATION PARAMETERS

μ = _______

σ = _______

n = _______

SAMPLE STATISTICS

$\bar{X}$ = _______

$\sigma_{\bar{X}}$ = _______

H₀ : __________

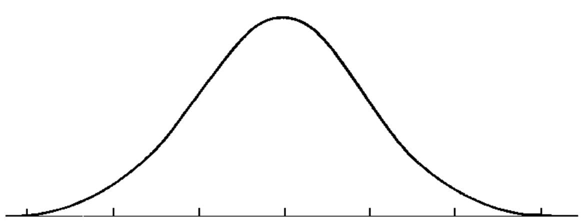
Hₐ : __________

Standard Error for the Mean

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$$

Formula 5.1

$$z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$$



z = __________

2-tail: p = __________

Would you say that Ihno's class performed **significantly better** than previous classes?

☐ ***Provides evidence*** *Ihno's class performed* ***significantly better*** *than previous classes*

☐ ***No evidence*** *that Ihno's class performed any differently than previous classes*

EXPLAIN.

5	C	4. Hypothesis test: Mean (z-score)

Test both the **mathquiz** and **statquiz** variables for their resemblance to **normal distributions**.

Based on **skewness**, **kurtosis**, and the **Shapiro-Wilk statistic**, which variable has a sample distribution that is **not** very consistent with the *assumption of normality in the population*?

MATHQUIZ

Skewness

____

Kurtosis

____

Shapiro-Wilk

stat = ________

p = ________

<-- Type **R code** into Skeleton and Knit to get **pdf** including output

☐ ***NORMAL*** *(or normal'ish)* ☐ ***NOT NORMAL***

Sketch a plot you made in R by hand (histogram &/or qq plot)

STATQUIZ

Skewness

____

Kurtosis

____

Shapiro-Wilk

stat = ________

p = ________

<-- Type **R code** into Skeleton and Knit to get **pdf** including output

☐ ***NORMAL*** *(or normal'ish)* ☐ ***NOT NORMAL***

Sketch a plot you made in R by hand (histogram &/or qq plot)