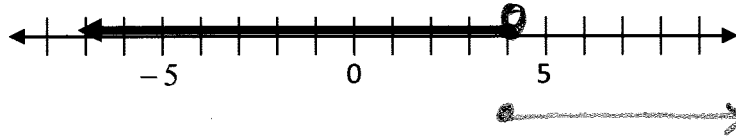The statement represents a claim. Write its complement and state which is H_0 and which is H_a. Identify which one is the claim.

1. $p = 0.83$

$H_0: p = 0.83$ (claim)

$H_a: p \neq 0.83$

2. $\mu \leq 123.5$

$H_0: \mu \leq 123.5$ (claim)

$H_a: \mu > 123.5$

3. $\sigma < 2.8$

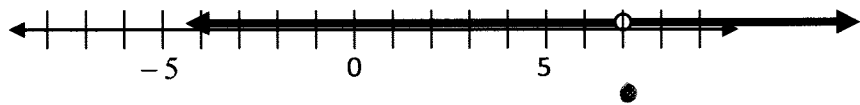$H_0: \sigma \geq 2.8$

$H_a: \sigma < 2.8$ (claim)

The alternative hypothesis is given with its graph. State the null hypothesis and sketch its graph.

4. $H_a: \mu < 4$

$H_0: \mu \geq 4$

5. $H_a: \mu \neq 7$

$H_0: \mu = 7$

Write the null and alternative hypotheses for each statement. Identify which one is the claim. State whether you do a left-tailed, right-tailed, or two-tailed test for the hypothesis test.

6.   The mean age of bus drivers in Sacramento is 47.2 years.

$H_0: \mu = 47.2$ (claim)

$H_a: \mu \neq 47.2$

two-tailed test

7.   The mean score for all MLB games during a particular season was less than 6 runs per game.

$H_0: \mu \geq 6$

$H_a: \mu < 6$ (claim)

left-tailed test

8.   Using the statement in problem #6, identify, in context, ~~identify~~ the type I and type II errors for the hypothesis test of this claim.

Type I: If the actual pop. mean age of bus drivers in Sacramento is 47.2 years, but we reject $H_0: \mu = 47.2$.

Type II: If the actual pop. mean age of bus drivers in Sacramento is not 47.2 years, but we fail to reject $H_0: \mu = 47$

9.   The mean age of bus drivers in Sacramento is 47.2 years. If a hypothesis test is performed; how should you interpret a decision that rejects the null hypothesis?
   a)   There is not sufficient evidence to reject the claim $\mu = 47.2$.
   (b))   There is sufficient evidence to reject the claim $\mu = 47.2$.
   c)   There is sufficient evidence to support the claim $\mu = 47.2$.
   d)   There is not sufficient evidence to support the claim $\mu = 47.2$.

   B

10.   Given $H_0: \mu \geq 20.2$, for which confidence interval should you reject H_0?
   a) $(18.5, 20.5)$
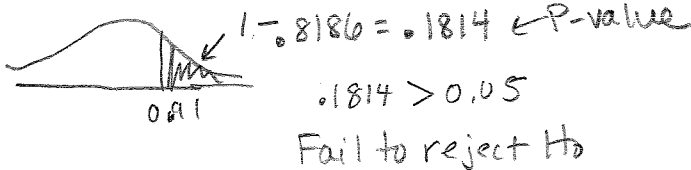   (b)) $(17.6, 19.6)$
   c) $(19.8, 20.8)$

   B

11. The P-value for a hypothesis test is P = 0.045. Do you reject or fail to reject H_0 when the level of significance is $\alpha = 0.01$? What if the level of significance is $\alpha = 0.05$?
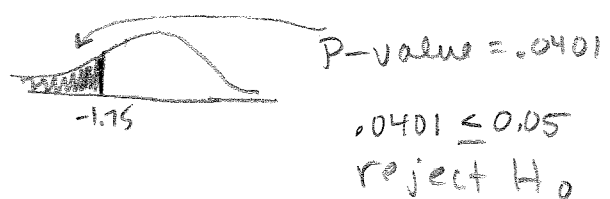
$\alpha = .01$
0.045 > .01   fail to reject H_0

$\alpha = 0.05$
0.045 ≤ 0.05   reject H_0

Find the P-value for the hypothesis test with the standardized test statistic z. Decide whether to reject H_0 for the level of significance α.
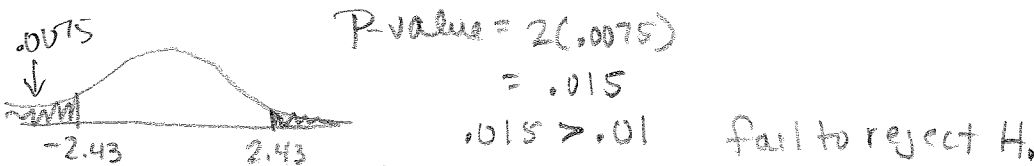
12. Right-tailed test, $z = 0.91$, $\alpha = 0.05$

1 − .8186 = .1814 ← P-value
.1814 > 0.05
Fail to reject H_0

13. Left-tailed test, $z = -1.75$, $\alpha = 0.05$

P-value = .0401
.0401 ≤ 0.05
reject H_0

14. Two-tailed test, $z = 2.43$, $\alpha = 0.01$

P-value = 2(.0075)
= .015
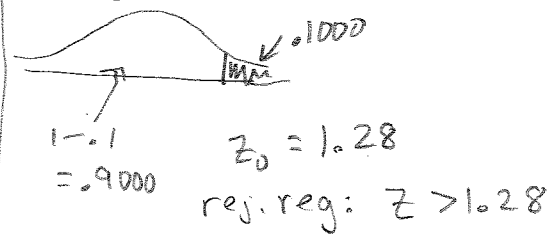.015 > .01   fail to reject H_0

Find the critical value and rejection region for the type of z-test with level of significance α.

15. Two-tailed test, $\alpha = 0.04$

$\frac{.04}{2} = .02$
$z_0 = \pm 2.05$
rej. reg: $z < -2.05$ or $z > 2.05$
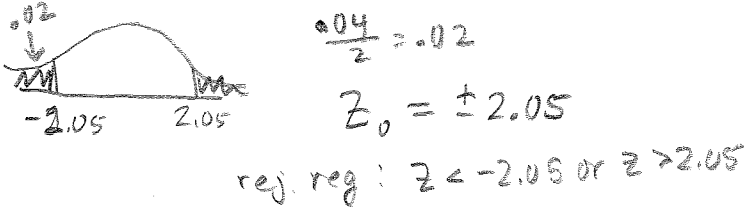
16. Right-tailed test, $\alpha = 0.10$

$1 - .1 = .9000$
$z_0 = 1.28$
rej. reg: $z > 1.28$

17. A coffee shack claims that the mean waiting time in line is less than 2.9 minutes. A random sample of 60 customers has a mean of 2.8 minutes with a population standard deviation of 0.4 minute. If $\alpha = 0.05$, test the coffee shack's claim. Use a P-value.

$H_0: \mu \geq 2.9$
$H_a: \mu < 2.9$ (claim)
left-tailed

$z = \frac{2.8 - 2.9}{\frac{.4}{\sqrt{60}}} = -1.94$

P-value = .0262
.0262 ≤ .05   reject H_0

(There is enough evidence at the 5% level of significance to support the coffee shack's claim that the mean wait time in line is less than 2.9 minutes.

18. A manufacturer claims that the mean lifetime of its fluorescent bulbs is 1000 hours. A homeowner selects 40 bulbs and finds the mean lifetime to be 990 hours with a population standard deviation of 80 hours. Test the manufacturer's claim. Use $\alpha = 0.05$ and rejection regions.

$H_0: \mu = 1000$ (claim)
$H_a: \mu \neq 1000$
two-tailed

$\alpha = .05$
$\frac{.05}{2} = .0250$
$z_0 = \pm 1.96$
rejection reg: $z < -1.96$ or $z > 1.96$

$z = \frac{990 - 1000}{\frac{80}{\sqrt{40}}} = -.79$

Fail to reject H_0

(There is not enough evidence at the 5% level of significance to reject the claim that the mean life time of it's fluorescent bulbs is 1000 hours.