Hypothesis test checklist:

1. State hypotheses; check assumptions if requested
2. State test statistic, df, and $pvalue$
3. Results of test (reject or not)
4. Conclusion of test with context
5. State potential error (Type I happens when null is rejected, or Type II happens when null is NOT rejected)

New York City, NY is known as the "city that never sleeps." A random sample of 25 New Yorkers was taken and they were asked how much sleep they get per night. Hours of sleep follow an approximate normal distribution. Is there sufficient evidence that New Yorkers get a different amount of sleep from the "norm"; a full 8 hours of sleep?

One Sample t-test

data: ny
t = 0.45284, df = 24, p-value = 0.6547
alternative hypothesis: true mean is not equal to 8
95 percent confidence interval:
 7.527738 8.737749
sample estimates:
mean of x
 8.132743

1. State hypotheses; check assumptions if requested
   $$H_0: \mu = 8 \; vs. H_a: \mu \neq 8$$
   * independence (met because random)
   * random (met)
   * normality (met because stated)
2. State test statistic, df, and $pvalue$
   t = 0.45284, df = 24, p-value = 0.6547
3. Results of test (reject or not)
   Reject null if $pvalue \leq \alpha(0.05)$
   $pvalue = 0.6547 \nleq \alpha(0.05) \therefore H_0$ is not rejected, results are not significant
   With a $pvalue = 0.6547$, that means if the null is correct, we would get these results due to random chance (dumb luck) 65.47% of the time
4. Conclusion of test with context
   Since the null was not rejected, we can conclude that New Yorkers get around the recommended 8 hours of sleep nightly
5. State potential error (Type I happens when null is rejected, or Type II happens when null is NOT rejected)
   Since the null was not rejected, we could have made a Type II error (not rejecting a false hypothesis). That means we think New Yorkers get around 8 hours of sleep when they get something other than 8 hours of sleep

Ingots are huge pieces of metal often weighing more than 10 tons (20,000 lbs.). They must be cast in one large piece for use in fabricating large structural parts for cars and planes. If they crack while being made, the crack can propagate into the zone required for the part, compromising its integrity; metal manufacturers would like to avoid cracking if at all possible. In one plant, only about 80% of the ingots have been defect-free. In an attempt to reduce the cracking, the plant engineers and chemists have tried some new methods for casting the ingots and from a random sample of 500 ingot cast in the new method, 16% of the casts were found to be defective (cracked). Is there sufficient evidence that the defective rate has decreased?

One Sample t-test

data: ingots
t = -2.4373, df = 499, p-value = 0.007573
alternative hypothesis: true mean is less than 0.2
95 percent confidence interval:
 -Inf 0.1870448
sample estimates:
mean of x
 0.16

1. State hypotheses; check assumptions if requested
$$H_0: \pi = 0.2 \; vs. H_a: \pi < 0.2$$
*independence (yes because random)
*random (yes)
*normality ($n = 500 \geq 60$ yes)
2. State test statistic, df, and $pvalue$
t = -2.4373, df = 499, p-value = 0.007573
3. Results of test (reject or not)
Reject null if $pvalue \leq \alpha(0.05)$
$pvalue = 0.007573 \leq \alpha(0.05) \therefore H_0$ is rejected (results are significant)
4. Conclusion of test with context
Since null was rejected, we conclude that the defect rate has decreased with the new formula
5. State potential error (Type I happens when null is rejected, or Type II happens when null is NOT rejected)
Since the null was rejected we could have made a Type I error (rejecting a true hypothesis). We think the new method has significantly decreased the defect rate but it has not