\( \hat{p}_n = \frac{473}{827} = 0.572 \quad \hat{p}_N = \frac{19}{130} = 0.146 \quad z^* = 1.96 \)

a) Standard error is just the standard deviation part of the formula so do that in the CI.

b) 0 \( \text{true proportion of dogs with malignant lymphoma from homes using herbicides} \)

\( \text{true proportion of dogs with malignant lymphoma from homes NOT using herbicides} \)

2-Prop Z-Interval

3. Assume random samples
   - Lymphoma incidence is independent between dogs
   - 957 dogs are less than 10% of all pet dogs
   - \( n \hat{p}_n > 10 \quad n \hat{q}_n > 10 \quad 473 > 10^\checkmark \quad 354 > 10^\checkmark \)
   - \( n \hat{p}_N > 10 \quad n \hat{q}_N > 10 \quad 19 > 10^\checkmark \quad 111 > 10^\checkmark \)
   - Large enough samples, approx. Normal

4. \( (0.572 - 0.146) \pm 1.96 \sqrt{\frac{0.572(0.428) + 0.146(0.864)}{827} + \frac{0.146(0.864)}{130}} \)

= \((0.356, 0.495)\)
\[ \hat{p}_s = 0.80 \quad \hat{p}_w = 0.54 \quad z^* = 1.96 \]

\[ n_s = 88 \quad n_w = 88 \]

1. \( p_s = \) true proportion of carpal tunnel patients who improved after surgery
2. \( p_w = \) true proportion of carpal tunnel patients who improved after wrist splints
3. 2-prop z-interval
4. Assume randomly assigned to treatments
   - Patients independent with respect to improvement
   - 176 people less than 10% of all carpal tunnel sufferers
5. \( n \hat{p}_s > 10 \quad n \hat{p}_w > 10 \)
   - 88(1.8) > 10
   - 70.4 > 10
   - 176 > 10
6. I am 95\% confident that the true proportion of carpal tunnel patients who improved after surgery is between 12.6\% and 39.4\% higher than those who improved after using wrist splints.

\[ (0.80 - 0.54) \pm 1.96 \sqrt{\frac{(0.8)(0.2)}{88} + \frac{(0.54)(0.46)}{88}} \]

\[ = (0.116, 0.384) \quad \text{calc \rightarrow x's rounded} \]

\[ = (0.126, 0.394) \quad \text{by hand \rightarrow more accurate} \]
\(\hat{p}_w = .248 \quad \hat{p}_b = .257 \quad Z^* = 1.645\)

1. \(p_w = \text{true proportion of white adults who smoke}\)
2. \(p_b = \text{true proportion of black adults who smoke}\)
3. 2-prop z-interval
4. Assume random samples
   - Smoking independent between people
   - 550 white adults and 550 black adults less than 10% of their respective populations
   - \(n\hat{p}_w > 10\)
   - \(550(0.248) > 10\)
   - \(550 > 10\)
   - \(136.4 > 10\)
   - \(n\hat{p}_b > 10\)
   - \(550(0.257) > 10\)
   - \(413.6 > 10\)
   - \(n\hat{p}_w > 10\)
   - \(550(0.752) > 10\)
   - \(408.7 > 10\)
   - \(n\hat{p}_b > 10\)
   - \(550(0.743) > 10\)
   - \(408.7 > 10\)

5. I am 90% confident that the true proportion of white adults who smoke is between 5.2% lower to 3.4% higher than black adults.

b) Since \(\mathcal{D}\) lies on the interval I can conclude there is no race-based difference in smoking rates among American adults.

\[ (0.248 - 0.257) \pm 1.645 \sqrt{\frac{(0.248)(0.752) + (0.257)(0.743)}{550}} \]

= \((-0.032, 0.034)\) calc

= \((-0.032, 0.034)\) by hand
\( \hat{p}_1 = 0.08 \quad \hat{p}_2 = 0.04 \)
\( n_1 = 182 \quad n_2 = 2300 \)
\( x_1 = 0.08(182) = 15 \quad x_2 = 0.04(2300) = 92 \)

1. \( p_p \) = proportion of women exposed to pollution from 9/11 that had low birthweight babies.

2. \( p_n \) = proportion of women who had low birthweight babies and were NOT exposed to 9/11 pollution.

\[
H_0: p_p = p_n \quad (p_p = p_n)
\]

\[
H_a: p_p = p_n > 0 \quad (p_p > p_n)
\]

2. \( \text{2-prop } Z\text{-test} \)

\( p_c = \text{common proportion of low birthweight babies} \)

\[
p_c = \frac{15 + 92}{182 + 2300} = 0.043
\]

3. \( \text{Assume samples are representative of their populations.} \)

4. \( \text{Birthweight between babies in samples is independent.} \)

5. \( 182 \text{ women and } 2300 \text{ women are less than } 10\% \text{ of their respective populations.} \)

\( n_1 p_1 > 5 \quad n_2 p_2 > 5 \)

\[
182(0.043) > 5 \quad 182(0.957) > 5
\]

\[
7.8 > 5v \quad 174.2 > 5v
\]

Large enough samples, approx. normal.

\[
Z = \frac{(0.08 - 0.04) - 0}{\sqrt{0.043(1 - 0.043) + 0.043(1 - 0.043)}}
\]

\[
Z = 2.712
\]

\( p\text{-value} = 0.0033 \)

Since the \( p\text{-value} \) of \( 0.0033 < \alpha \) of .05, I reject \( H_0 \). There is sufficient evidence to suggest that the proportion of low birthweight babies is higher in the women exposed to 9/11 pollution than those not exposed.
\(b\) use C.I. (calc)

2-prop \(z\)-interval \(\pm 95\%\) confidence

\[(0.002, 0.083)\]

Anywhere from 0.2% to 0.8% higher for women exposed to \(9/11\) pollution.

\(p_o = \text{proportion of voters supporting candidate before affair}\)

\(p_a = \text{proportion of voters supporting candidate after affair}\)

\[H_o: \ p_a - p_o = 0\]

\[H_a: \ p_a - p_o < 0\]

2-prop \(z\)-test

\[p_c = \text{common proportion of voters supporting candidate}\]

\[p_c = \frac{340 + 515}{630 + 1010} = 0.521\]

\(z = \frac{(0.51 - 0.54)}{\sqrt{\frac{0.521(0.479)}{630} + \frac{0.521(0.479)}{1010}}} = -1.174\)

\(p\)-value = 0.12

Since the \(p\)-value of 0.12 > \(\alpha\) of 0.05, I fail to reject \(H_o\).

There is insufficient evidence to suggest that the proportion of voters supporting the candidate decreased significantly after news of his affair.

Large enough samples, Approx. Normal
(7b) 2-prop $z$-interval w/ 95% conf. 

$$(.51 - .54) \pm 1.96 \sqrt{\frac{(1)(.49)}{1010} + \frac{(54)(.46)}{630}}$$

$$= (-.079, .0199)$$

I am 95% confident that the true proportion of voters supporting the candidate after news of the affair is between 7.9% lower to 2% higher than before the affair was exposed. Therefore, since 0 is on the interval there is possibly no difference between the samples. The affair did not significantly affect voters' opinions. (How sad - people should watch the news!)

(24) (Do conditions for parts a, b, d together)

- Assume random samples of men and women
- Opinions are independent between men and women
- 473 men and 522 women are less than 10% of their respective populations
- $n\hat{p}_m > 10$  
  $n\hat{p}_w > 10$ 
  $473(p_{.52}) > 10$ 
  $246 > 10$ 
- $n\hat{q}_m > 10$  
  $n\hat{q}_w > 10$ 
  $522(p_{.48}) > 10$ 
  $275 > 10$ 
  Large enough samples, Approx. normal

a) $p_m = \text{proportion of men who may vote for candidate}$

1-prop $z$-interval

$$.52 \pm 1.96 \sqrt{\frac{(.52)(.48)}{473}}$$

$$= (.475, .565)$$

I am 95% confident that the true proportion of men who may vote for the candidate is between 47.5% and 56.5%.
b) \( p_w = \text{proportion of women who may vote for candidate} \)
\[
1 - \text{prop z-interval} \\
0.45 \pm 1.96 \sqrt{\frac{(0.45)(0.55)}{522}} \\
= (0.408, 0.493)
\]
I am 95% confident that the true proportion of women who may vote for the candidate is between 40.8% and 49.3%.

c) Yes, the two intervals overlap.
\[
\begin{array}{cccccccc}
0.40 & 0.42 & 0.44 & 0.46 & 0.48 & 0.50 & 0.52 & 0.54 & 0.56 & 0.58 \\
\hline \\
p_m & p_w & & & & & & & &
\end{array}
\]
This implies there may be no difference between the 2 samples and no real gender gap.

d) 2-prop z-interval
\[
(0.52 - 0.45) \pm 1.96 \sqrt{\frac{(0.52)(0.48)}{473} + \frac{(0.45)(0.55)}{522}}
\]
= (0.008, 0.132)
I am 95% confident that the true proportion of men who may vote for the candidate is between 0.8% and 13.2% higher than women.

e) This interval does NOT contain 0, meaning there is a difference between men and women voters.

f) Correct approach is the 2-prop z-interval because it correctly combines the two standard deviations by adding the variances therefore giving a better estimate.