2. (a), (c), (d) and (e)

3. (d)

4. (d)

5. (b)

6. (b)

7. (a) Since 68% of values lie within 1 standard deviation of the —that is, between 85 and 115—32% of values lie outside of that interval, with half of them, 16%, being below 85.

   (b) Our standardized score, since we know $\sigma = 15$, is a Z-score. We do not have to standardize, in fact, but noting that σ is available tells us we can use `pnorm`:

```
1 - pnorm(107, 100, 5)
```

9. (a) $z^* = 2.3263$. We have point estimate

$$\widehat{p} = \frac{58}{144} \doteq 0.403, \qquad \text{and} \qquad \mathrm{SE}_{\widehat{p}} \approx \sqrt{\frac{(0.368)(0.632)}{144}} \doteq 0.04087,$$

   so our 96% confidence interval is

$$0.403 \pm (2.3263)(0.04087), \qquad \text{or} \qquad (0.308, 0.498).$$

   (b) Our z^*-value for the requested level of confidence is $z^* = 2.054$. Applying the formula, we have

$$n \geq \left(\frac{2.054}{0.01}\right)^2 (0.07)(0.93) \doteq 2746.51.$$

   Thus, the minimum n is 2747.

10. (a) Letting μ represent the average pulse among U.S. adult males, we have null hypothesis

$$\mathbf{H}_0\colon\ \mu = 72 \qquad \text{with alternative} \qquad \mathbf{H}_a\colon\ \mu \neq 72.$$

   (b) The test statistic most directly of use in determining a P-value is the t-score:

$$t \ = \ \frac{69.4 - 72}{11.3/\sqrt{40}} \ \doteq \ -1.455.$$

   In this command we have used that the point estimate is the sample mean $\bar{x} = 69.4$, the sample standard $s = 11.3$, and the sample size is $n = 40$. Using $40 - 1 = 39$ degrees of freedom, our P-value is the result of the command

```
2 * pt(-1.455, 39)
```

   (c) Our critical value is appropriately named t^*, coming from a t-distribution with 39 degrees of freedom. As a 94% CI leaves 3% in each tail, the command that yields t^* is

```
qt(0.97, 39)
```

   (d) A 94% CI is

$$69.4 \pm (1.937)\frac{11.3}{\sqrt{40}}, \qquad \text{or} \qquad [65.94, 72.86].$$

11. (a) Integrating f gives

$$\begin{aligned}
\Pr(X < 0) &= \int_{-\infty}^{0} f(x)\,dx \;=\; \frac{3}{4}\int_{-1}^{0}\left(1 + x - x^2 - x^3\right) dx \\
&= \frac{3}{4}\left[x + \frac{1}{2}x^2 - \frac{1}{3}x^3 - \frac{1}{4}x^4\right]_{-1}^{0} \;=\; \frac{3}{4}\left[0 - \left(-1 + \frac{1}{2} + \frac{1}{3} - \frac{1}{4}\right)\right] \\
&= -\frac{3}{4}\left(-\frac{12}{12} + \frac{6}{12} + \frac{4}{12} - \frac{3}{12}\right) \;=\; \left(-\frac{3}{4}\right)\left(-\frac{5}{12}\right) \;=\; \frac{5}{16}.
\end{aligned}$$

(b) From what we just learned in part (a), 0 is at the position dividing the lowest $5/16$ from the upper $11/9$ of the total area 1; that is, it is at approximately the 31.25^{th} percentile. The median is the 50^{th} percentile, and hence further to the right of 0 (i.e., it is positive).

(c) The expected value

$$\begin{aligned}
E(X) &= \int_{-\infty}^{\infty} x f(x)\,dx \;=\; \frac{3}{4}\int_{-1}^{1}\left(x + x^2 - x^3 - x^4\right) dx \\
&= \frac{3}{4}\left[\frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 - \frac{1}{5}x^5\right]_{-1}^{1} \;=\; \frac{3}{4}\left[\left(\frac{1}{2} + \frac{1}{3} - \frac{1}{4} - \frac{1}{5}\right) - \left(\frac{1}{2} - \frac{1}{3} - \frac{1}{4} + \frac{1}{5}\right)\right] \\
&= \frac{3}{4}\left(\frac{2}{3} - \frac{2}{5}\right) \;=\; \frac{3}{4}\left(\frac{10}{15} - \frac{6}{15}\right) \;=\; \left(\frac{3}{4}\right)\left(\frac{4}{15}\right) \;=\; \frac{1}{5}.
\end{aligned}$$

(d) $F(2.5) = 1$, having accumulated all the area there is under the pdf.