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

3. (c)

4. (a)

5. (c)

6. (c)

7. (a) Since an IQ of 130 is 2 standard deviations above the mean of 100, the adults with IQs below 130 include all those with 2 standard deviations (the 95%) plus those in the lower tail of the distribution (2.5%). Thus, adults with IQs below 130 are about 97.5% of the population.

   (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(110, 100, 15/4)
```

9. (a) From the back sheet, the critical value is $z^* = 2.0537$. We have point estimate

$$\widehat{p} = \frac{53}{144} \doteq 0.368, \qquad \text{and} \qquad \mathrm{SE}_{\widehat{p}} \approx \sqrt{\frac{(0.368)(0.632)}{144}} \doteq 0.04019,$$

   so our 96% confidence interval is

$$0.368 \pm (2.0537)(0.04019), \qquad \text{or} \qquad (0.285, 0.451).$$

   (b) Our z^*-value for the requested level of confidence is $z^* = 1.751$. Applying the formula, we have

$$n \geq \left(\frac{1.751}{0.02}\right)^2 (0.15)(0.85) \doteq 977.29.$$

   Thus, the minimum n is 978.

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

$$\begin{aligned}
\Pr(X<0) &= \int_{-\infty}^{0} f(x)\,dx = \int_{-1}^{0}\left(\frac{8}{27}+\frac{4}{9}x-\frac{4}{27}x^3\right)dx \\
&= \left[\frac{8}{27}x+\frac{2}{9}x^2-\frac{1}{27}x^4\right]_{-1}^{0} = 0-\left(-\frac{8}{27}+\frac{2}{9}-\frac{1}{27}\right) \\
&= \frac{8}{27}-\frac{6}{27}+\frac{1}{27} = \frac{1}{9}.
\end{aligned}$$

(b) From what we just learned in part (a), 0 is at the position dividing the lowest 1/9 from the upper 8/9 of the total area 1; that is, it is at approximately the 11$^{\text{th}}$ percentile. The median is the 50$^{\text{th}}$ percentile, and hence further to the right of 0 (i.e., it is positive).

(c) The expected value

$$\begin{aligned}
\mathrm{E}(X) &= \int_{-\infty}^{\infty} xf(x)\,dx = \int_{-1}^{2}\left(\frac{8}{27}x+\frac{4}{9}x^2-\frac{4}{27}x^4\right)dx \\
&= \left[\frac{4}{27}x^2+\frac{4}{27}x^3-\frac{4}{135}x^5\right]_{-1}^{2} = \left(\frac{16}{27}+\frac{32}{27}-\frac{128}{135}\right)-\left(\frac{4}{27}-\frac{4}{27}+\frac{4}{135}\right) \\
&= \frac{80}{135}+\frac{160}{135}-\frac{128}{135}-\frac{4}{135} = \frac{108}{135} = \frac{4}{5}.
\end{aligned}$$

(d) $F(5)=1$, having accumulated all the area there is under the pdf.