(a) It is moving fastest when the top of the graph is, between 1.5 and 3.0 hours after release. Its speed there is roughly 85 miles per hour.

(b) The balloon changes direction when the graph of the velocity crosses the x-axis, approximately 3.75 hours after release.

(c) The total distance travelled east is about \( \int_{0}^{3.75} V(t) \, dt \) miles, which can be obtained by counting the number of rectangles between the graph and the x-axis between \( t = 0 \) and \( t = 3.75 \), then multiplying by 30. I estimate (counting portions of squares on rectangles), that there are 6.5 rectangles under this portion of the graph giving \( 6.5 \times 30 = 195 \) miles east of the starting position.

(d) (i) Again, rectangles are counted, to obtain
\[ 2 \times (30) = 60 \text{ miles}. \]

(ii) \[ 195 - 1 \times (30) \approx 192 \text{ miles east of the starting position}. \]

(iii) \[ 195 - 2 \times (30) \approx 120 \text{ miles east of the starting position}. \]
2. (a) \( \int_{-1}^{1} xe^{-x^2} \, dx = 0 \) because \( xe^{-x^2} \) is an odd function.

(b) \( \int_{-1}^{1} x^2 \, dx = 2 \int_{0}^{1} x^2 \, dx = \frac{2x^3}{3} \bigg|_{x=0}^{x=1} = \frac{2}{3} \)

(c) \( \int_{-1}^{1} x^2 + x \, dx = \int_{-1}^{1} x^2 \, dx + \int_{-1}^{1} x \, dx = 2 \int_{0}^{1} x^2 \, dx = \frac{2}{3} \)

3. \( \int_{-1}^{1} 2f(x) + g(x) \, dx = \int_{-1}^{1} 2f(x) \, dx + \int_{-1}^{1} g(x) \, dx \)

\[
= 2 \int_{-1}^{1} f(x) \, dx + \int_{-1}^{1} g(x) \, dx + 2 \int_{-1}^{1} f(x) \, dx + \int_{-1}^{1} g(x) \, dx
\]

\[
= 2 \left( \int_{-1}^{1} g(x) \, dx + 2 \int_{-1}^{1} f(x) \, dx + \int_{-1}^{1} g(x) \, dx \right)
\]

\[
= 2 \left( 2(2) + 2(1) + 3 \right) = 4 + 2 + 3 = 9
\]

4. The average value is:

\[
\frac{1}{4 - 0} \int_{0}^{4} x^2 \, dx = \frac{1}{4} \left[ \frac{x^3}{3} \right]_{x=0}^{x=4}
\]

\[
= \frac{1}{4} \cdot \frac{4^3}{3} = \frac{16}{3}
\]