1) \((-113, -\frac{2}{3})\)  
- x-coordinate: \(-171 + \frac{1}{3}(3 - (-171))\); y-coordinate: \(26 - \frac{1}{3}(26 - (-54))\)

2) Each of the regular polygons listed can be constructed with only a compass and straightedge: square, regular pentagon, regular dodecagon, and regular 17-gon.

3) \(\frac{5}{2}\)  
- Area of a trapezoid: \(\frac{1}{2} \cdot h(b_1 + b_2) = \frac{1}{2} \cdot 2(12 + b_2) = 27\), so \(b_2 = 15\).
- Half the excess length of \(b_2\) is \(\frac{3}{2}\). The desired length is \(\sqrt{2^2 + \left(\frac{3}{2}\right)^2} = \frac{\sqrt{25}}{4}\)

4) \(8 + 8\sqrt{2} - 8\sqrt{3}\)  
- Add four corner triangles to form a square. A side of the square is \(2 + 2\sqrt{2}\).
- Area of the square, minus area of the four corner triangles, minus the area of all eight equilateral triangles = \((2 + 2\sqrt{2})^2 - 4\left(\frac{1}{2} \cdot \sqrt{2} \cdot \sqrt{2}\right) - 8\left(\frac{1}{2} \cdot 2\sqrt{3}\right)\)
  = \(4 + 8\sqrt{2} + 8 - 4 - 8\sqrt{3}\).

5) \(9\) hours  
- Volume of frustrum = \(\frac{1}{3}h(a^2 ab b^2) = \frac{1}{3}(12)(a^6 6(15) 15^2) = 1404\) ft\(^3\)
- Fill time = \(\frac{1404\) ft\(^3\)}{(26 ft\(^3\)/10 min) = \(\frac{9\, \text{ft}^3}{10 \, \text{min}}\) = \(2 \cdot 9 \cdot 3 \cdot 10 \, \text{min}\) or \(9(60 \, \text{min}) = 9\) hr

6) \(x = 3\)  
- area(\(\square ABCD\)) = area(\(\triangle AEF\)) + [area(\(\triangle ABE\) + area(\(\triangle ADF\))] + area(\(\triangle CEF\))
  \[25 = \frac{21}{2} + 2 \left[\frac{1}{2} \cdot AD \cdot FD\right] + \frac{1}{2} \cdot CE \cdot CF\]
  \[25 = \frac{21}{2} + 5(5 - x) + \frac{1}{2} x^2\]
  \[0 = 21 - 10x + x^2\]
- The solutions to the quadratic are \(x = 3\) and \(x = 7\), but \(x = 7\) makes line segment CE longer than a side of square ABCD, thus is extraneous.

7) \(362\)  
- For a convex \(n\)-gon the number of degrees of its interior angles is \(T = 180(n - 2)\). We want the minimum \(n\) such that \(D > T\): \(\frac{1}{2}n(n - 3) > 180(n - 2)\)
  \[n(n - 3) > 360(n - 2)\]
  \[n^2 - 3n > 360n - 720\]
  \[n^2 - 363n + 720 > 0\]
- We can see that the left side is positive for \(n = 363\); it reduces to 720. It just remains to see if the left side is positive for any slightly smaller value of \(n\).
  \[n = 362: \quad 362^2 - (363)(362) + 720\]
  = \(362^2 - 362^2 - 362 + 720 = 358\)
  \[n = 361: \quad 361^2 - (363)(361) + 720\]
  = \(361^2 - 361^2 - 2(361) + 720 = -2\)
8) Kite

9) \( \frac{9}{2} \sqrt{3} \)

Slide two of the triangles to each of vertices A, C, and E, as shown. The star’s area can now be divided into three equal regular hexagons of side 1, which can further be divided into 18 equilateral triangles of side 1. And that total area is \( 18 \left( \frac{1}{2} \cdot 1 \cdot \frac{\sqrt{3}}{2} \right) = \frac{9}{2} \sqrt{3} \)

10) B. trapezoid

1. quadrilateral LJKC: \( x + 93^0 + 89^0 + 58^0 = 360^0 \rightarrow x = 120^0 \)
2. \( \angle CLN = 87^0, \angle LCN = 60^0 \)
3. triangle LCN: \( y + 87^0 + 60^0 = 180^0 \rightarrow y = 33^0 \)
4. triangle BHG: \( 3y - 39^0 + \angle HBG \rightarrow \angle HBG = \angle IBL = 60^0 \)
   
   so we now know \( AB \parallel CD \).
5. \( \angle DMN = 10y - 2x = 330^0 - 240^0 = 90^0 \)
6. quadrilateral ABLM: \( \angle BAM + 120^0 + 93^0 + 90^0 = 360^0 \rightarrow \angle BAM = 57^0 \)
   
   OR: triangle MDN: \( \angle MDN + 90^0 + 33^0 = 180^0 \rightarrow \angle MDN = 57^0 \)
   
   so we now know \( AD \) not \( || \) \( BC \).

11) 117 feet

Similar triangles: \( \frac{h}{27.3 \text{ ft}} = \frac{36 \text{ in}}{8.4 \text{ in}} \rightarrow h = \frac{9(27.3) \text{ ft}}{2.1} = \frac{3(273)}{7} \text{ ft} = 3(39) \text{ ft} \)

12) \( 45 \leq h \leq 52.5 \)

The shadow of the hedge extends 4 feet from the face of the hedge farther from the tree. \( \frac{s}{5 \text{ ft}} = \frac{8 \text{ in}}{10 \text{ in}} \rightarrow s = \frac{8(60 \text{ in})}{10} = 48 \text{ in} \)

Thus the shadow of the tree is minimally 36 ft (to the hedge) and maximally 42 ft (to the end of the hedge’s shadow).

Similar triangles: \( \frac{h_{\text{min}}}{36 \text{ ft}} = \frac{10 \text{ in}}{8 \text{ in}} \rightarrow h_{\text{min}} = \frac{360 \text{ ft}}{8} = 45 \text{ ft} \)

and: \( \frac{h_{\text{max}}}{42 \text{ ft}} = \frac{10 \text{ in}}{8 \text{ in}} \rightarrow h_{\text{max}} = \frac{420 \text{ ft}}{8} = 52.5 \text{ ft} \)

13) \( 17 \leq A \leq 69 \)

   minimum: 16
   
   6 \times 1 = 6
   1 \times 1 = 1
   1 \times 9 = 9

   maximum: 69
   
   7 \times 10 = 70
   7 \times 1 = 1

14) 3598

\( x^2 + 4n > 120^2 \)

\( 9 + 4n > 14400 \)

\( 4n > 14391 \)

\( n > 3597.75 \)

\( \min n = 3598 \)