7. Let $x =$ the number of consecutive free throws needed.

$$\frac{16+x}{24+x}=\frac{86\frac{2}{3}}{100}=\frac{13}{15};\ 240+15x=13x+312;\ x=36.$$

8. Let c and d represent the diagonals of the rhombus, and s represent the length of a side. $\frac{c}{2}+\frac{d}{2}=31$ and $\frac{cd}{2}=336$. $\left(\frac{c}{2}\right)^2+\left(\frac{d}{2}\right)^2=s^2$ and $\left(\frac{c}{2}+\frac{d}{2}\right)^2=\left(\frac{c}{2}\right)^2+\left(\frac{d}{2}\right)^2+\frac{cd}{2}=961\rightarrow s^2+336=961\Rightarrow s^2=625.$
$s=25$ and $sh=336$, $\therefore h=\frac{336}{25}$

9. The probability that it will rain at least once is 1 minus the probability that it will not rain on any of the days. $1-(.6)(.7)(.4)(.75)(.5)=.937=93.7\%$

10. Let $\mathrm{EC}=x$, $\mathrm{AB}=x+2$, $\mathrm{EB}=x+4$, $\mathrm{BD}=x-4$, and $\mathrm{ED}=a$.

$$a^2+(x-4)^2=(x+4)^2;\ a^2+x^2-8x+16=x^2+8x+16$$

From $\triangle$ECD, $a^2=x^2-225$; Combining the equations $x^2-225=16x$
$x^2-16x-225=0$; $(x-25)(x+9)=0$; reject $-9, x=25$, $\mathrm{AB}=27$, $\mathrm{BD}=21$, $\mathrm{AD}=48$, $\mathrm{ED}=20$ and by the $\{5,12,13\}$ triple $\mathrm{AE}=52$.

11. Let $\mathrm{AD}=h$, and $\mathrm{CD}=b$. The area of $\triangle\mathrm{FDE}=\frac{1}{2}\left(\frac{h}{4}\right)\left(\frac{b}{5}\right)=\frac{bh}{40}$.

The area of $\triangle\mathrm{FCG}=\frac{1}{2}\left(\frac{4b}{5}\right)\left(\frac{h}{3}\right)=\frac{2bh}{15}$. The area of the pentagon is $bh\left(1-\left(\frac{1}{40}+\frac{2}{15}\right)\right)=\frac{101}{120}bh=50.5\Rightarrow bh=60.$

12. You need 3 of the 6 winning numbers, 2 of the 18 numbers that were not drawn, and the supplemental number. The probability that this will happen is $\frac{{}_6C_3\cdot{}_{18}C_2\cdot{}_1C_1}{{}_{25}C_6}=\frac{153}{8855}$.