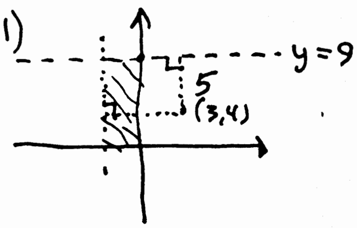
4-1)

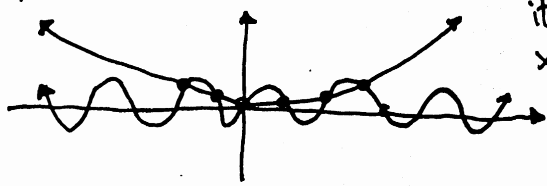


Rotate $y=9$ 90° counterclockwise with center $(3,4)$ and the line that was 5 units above $(3,4)$ is now 5 units to the left of $(3,4)$. It's the line $x=-2$. The area sought is $2\times 9 = \boxed{18}$.

4-2) Since $(1+x)^k = 1^k + k\cdot x + \frac{k(k-1)}{2}(x^2)+\ldots$ For $x=k$, $(1+k)^k = 1+k^2+\frac{k^3(k-1)}{2}+\ldots$
$\therefore k^2=\frac{1}{4}$, so $k=\frac{1}{2}$ or $k=-\frac{1}{2}$. For $k=\frac{1}{2}$, $\frac{k^3(k-1)}{2}<0$ ✗ $\quad = 1+\frac{1}{4}+\frac{1\cdot 3}{4\cdot 8}+\ldots$
$\therefore k=-\frac{1}{2}$ and
$N=(1-\frac{1}{2})^{-1/2}=(\frac{1}{2})^{-\frac{1}{2}} = 2^{\frac{1}{2}}=\sqrt{2}$ $\therefore$ $(k,n)=\boxed{(-\frac{1}{2},\sqrt{2})}$

4-3) If Ty wore a blue suit, he wore either blue socks or a white shirt. But if he wore blue socks, he also wore a white shirt. Thus, blue suit ⇒ white shirt. But blue suit and white shirt ⇒ blue tie. Since Ty always wears a red tie, he did not wear his blue suit. But gray suit ⇒ blue socks, and blue socks ⇒ white shirt. Therefore, Ty's wardrobe for his dates with Miss Fortune is gray suit, white shirt, blue socks.

4-4)



The period of $y=\sin 8x$ is $\frac{\pi}{4}$, so $\sin 8x$ reaches its max at $x=\frac{\pi}{16}+\frac{n\pi}{8}$, $n\in\mathbb{Z}$. The parabola $y=x^2>1$ when $|x|>1$. The sine wave will cross the parabola until $\frac{\pi}{16}+\frac{n\pi}{4}>1$, which happens if $|n|\ge 2$. As shown, there are $\boxed{6}$ intersections.

4-5) For any 5 tickets, there are $5! = 120$ ways to order them, only one of which is in increasing order. Thus, $P=\boxed{\frac{1}{120}}$.

4-6) The l.c.m of 2,3,4,5,6 is $2^2\cdot 3\cdot 5 = 60$, so the least such integer is $\boxed{2^{60}} = (2^{30})^2 = (2^{20})^3 = (2^{15})^4 = (2^{12})^5 = (2^{10})^6$.