$\boxed{1}$ Let $P(E)=0.2$ and $P(F)=0.5$, E,F mutually exlusive.

Hence $E\cap F=\phi$. So $P(E\cap F)=0$

- $P(E\cup F)=P(E)+P(F)-P(E\cap F)=0.7$
- $P(E^c)=1-P(E)=0.8$
- $P(E^c\cap F^c)=P((E\cup F)^c)=1-P(E\cup F)=1-0.7=0.3.$

$\boxed{2}$ Let $E=$ enrolled in math course

$F=$ enrolled in economics course.

Then $n(E)=225$, $n(F)=320$ and $n(E\cap F)=140$.

a) $P(E\cup F)=P(E)+P(F)-P(E\cap F)=\frac{225}{500}+\frac{320}{500}-\frac{140}{500}=0.81$

b) $P(E\cup F)-P(E\cap F)=0.81-0.28=0.53$

c) $P((E\cup F)^c)=1-P(E\cup F)=1-0.81=0.19$

$\boxed{3}$ a) There are $C(24,2)$ ways to select 2 bulbs and $C(4,2)$ ways of selecting 2 defective bulbs. Hence $\frac{C(4,2)}{C(24,2)}$

b) Let $E=$ none of the bulbs is defective.

Then E^c gives the event that at least 1 of the bulbs is defective

$$P(E^c)=1-P(E)=1-\frac{C(20,2)}{C(24,2)}.$$

$\boxed{4}$ Let $A=$ words in exam and $B=$ words you know.

Then you want to have $n(A\cap B)\geq 8$. So the possibilities are $n(A\cap B)=8,9,10$. But then

$P(n(A\cap B)=8)$ is the probability the the student knows exactly 8 words out of 10.

That probability is given by.

$$\frac{C(12,8)\cdot C(8,2)}{C(20,10)}$$

Similarly for $P(n(A\cap B)=9)$ and $P(n(A\cap B))=10$

So the answer is

$$\frac{C(12,8)\cdot C(8,2)}{C(20,10)}+\frac{C(12,9)\cdot C(8,1)}{C(20,10)}+\frac{C(12,10)\cdot C(8,0)}{C(20,10)}$$

$\boxed{5}$ There are in total $C(52,2)$ ways to select a hand.

a) You want the first letter to be 10, J, Q, K or A. So that can happen in $C(20,1)$ ways. You want the second letter to be 10, J, Q, K, A as well. Now that can happen in $C(19,1)$ ways. So

$$\frac{C(19,1)\cdot C(20,1)}{C(52,2)}$$

b)

Similarly as in a)

$$\frac{C(40,1)\cdot C(39,1)}{C(104,2)}$$

$\boxed{6}$ As in example 2, page 426

$A = \{\text{sum is } \underline{\text{less}} \text{ than } 8\} \Rightarrow n(A) = 26$

$B = \{\underline{\text{at least}} \text{ one number is } 6\} \Rightarrow n(B) = 11$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{\frac{4}{36}}{\frac{11}{36}} = \frac{4}{11}$$

$A \cap B = \{(6,1), (6,2), (1,6), (2,6)\}$