(1.) $P(A) = \frac{1}{2}$, $P(B) = \frac{2}{6} = \frac{1}{3}$

$\therefore$ $P(A \text{ and } B) = P(A)P(B)$ by independence

$= \left(\frac{1}{2}\right)\left(\frac{1}{3}\right)$

$= \boxed{\frac{1}{6}}$

(2.) $P(\text{first player makes shot}) = \frac{1}{2}$

$\therefore$ $P(\text{first player misses shot}) = 1 - \frac{1}{2} = \frac{1}{2}$

$P(\text{second player makes shot}) = \frac{2}{5}$

$\therefore$ $P(\text{second player misses shot}) = 1 - \frac{2}{5} = \frac{5}{5} - \frac{2}{5} = \frac{3}{5}$

$P(\text{at least one player makes shot})$

$= 1 - P(\text{both miss shots})$

$= 1 - P(\text{first player misses})\,P(\text{second player misses})$

– by independence

$= 1 - \left(\frac{1}{2}\right)\left(\frac{3}{5}\right)$

$= 1 - \frac{3}{10}$

$= \frac{10}{10} - \frac{3}{10}$

$= \boxed{\frac{7}{10}}$.

(3.) $P(\text{King } \underline{\underline{\text{or}}} \text{ heart})$

writing the collection of outcomes "King $\underline{\underline{\text{or}}}$ heart" as disjoint event: "non-heart King" $\underline{\underline{\text{or}}}$ "heart"

$$= P(\text{non-heart King } \underline{\underline{\text{or}}} \text{ heart})$$

$$= P(\text{non-heart King}) + P(\text{heart})$$

$$= \frac{3}{52} + \frac{13}{52}$$

$$= \frac{\cancel{16}\ 4}{\cancel{52}\ 13}$$

$$= \boxed{\frac{4}{13}}$$

(4.) $P(\text{first heart, } 2^{nd} \text{ is black face card})$

$$= P(\text{first heart})\,P(2^{nd} \text{ is black face card}) \text{ by independence.}$$

$$= \left(\frac{13}{52}\right)\left(\frac{6}{52}\right)$$

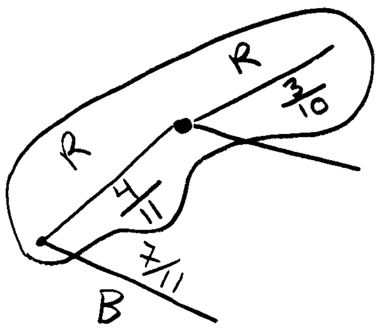
$$= \left(\frac{1}{4}\right)\left(\frac{3}{26}\right)$$

$$= \boxed{\frac{3}{104}}$$

(5.) "even number less than 10" $= \{(1,1), (1,3), (3,1), (2,2), (1,5)$
$(5,1), (2,4), (4,2), (3,3),$
$(2,6), (6,2), (3,5), (5,3),$
$(4,4)\}$

$$\therefore P(\text{"even number less than 10"}) = \frac{14}{36} = \boxed{\frac{7}{18}}$$

(6.) 4 R , 7 B



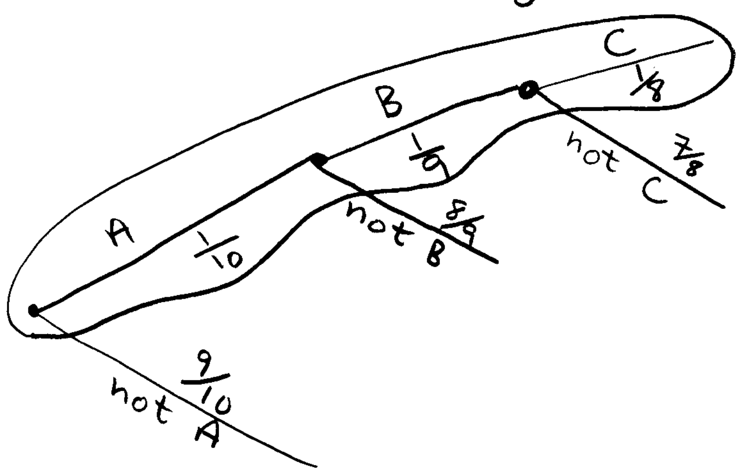
$\therefore$ P(first R, second R) $= \left(\frac{\cancel{4}^{\,2}}{11}\right)\left(\frac{3}{\cancel{10}_{\,5}}\right)$

$= \boxed{\frac{6}{55}}$

(7.) Let A = event "guess first horse correctly"

B = event "guess second horse correctly"

C = event "guess third horse correctly"



$\therefore$ P(A and B and C)

$= \left(\frac{1}{10}\right)\left(\frac{1}{9}\right)\left(\frac{1}{8}\right)$

$= \frac{1}{720}$

(8.) P(first less than three and second less than five)

$=$ P(first less than three) P(second less than five)

$= \left(\frac{2}{6}\right)\left(\frac{4}{6}\right)$

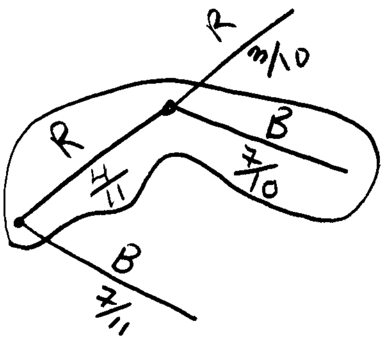
$= \left(\frac{1}{3}\right)\left(\frac{2}{3}\right)$

$= \boxed{\frac{2}{9}}$

(9.) P(one red, other blue)

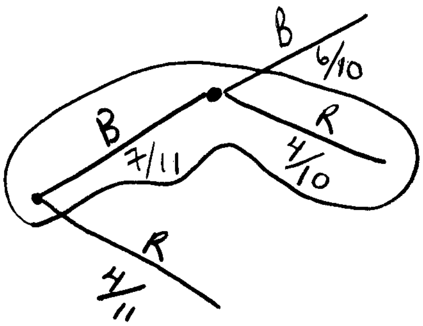
$= P(\text{first red, second blue}) + P(\text{first blue, second red}).$

P(first red, second blue) :



$$\left(\frac{\cancel{4}^{\,2}}{11}\right)\left(\frac{7}{\cancel{10}_{\,5}}\right) = \frac{14}{55}$$

P(first blue, second red) :



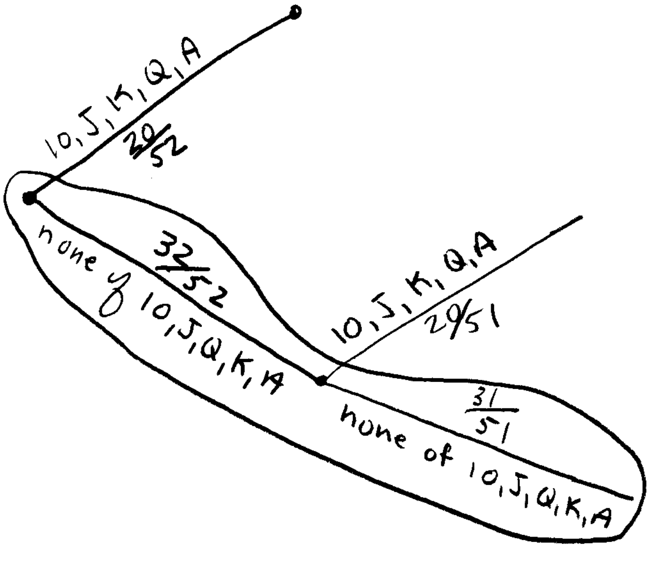
$$\left(\frac{7}{11}\right)\left(\frac{\cancel{4}^{\,2}}{\cancel{10}_{\,5}}\right) = \frac{14}{55}$$

$\therefore$ P(one red, other blue)

$$= \frac{14}{55} + \frac{14}{55}$$

$$= \boxed{\frac{28}{55}}$$

(10.) P(at least one of 10, J, Q, K, A) = 1 − P(none of 10, J, Q, K, A)



$$= 1 - \left(\frac{\cancel{32}^{\,8}}{\cancel{52}_{\,13}}\right)\left(\frac{31}{51}\right)$$

$$= 1 - \frac{248}{663}$$

$$= \frac{663}{663} - \frac{248}{663}$$

$$= \boxed{\frac{415}{663}}$$