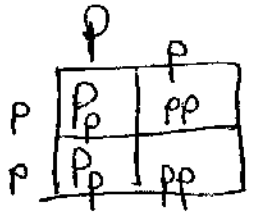
Genetics & Probability Worksheet **Name** Key

For the problems below, show all work, including the Punnett square and the mathematical calculations.

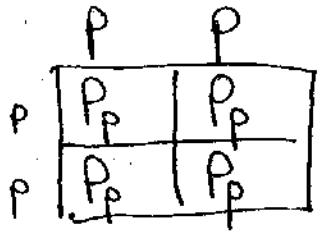
1. Polled cattle (no horns) are dominant to cattle with horns. If a heterozygous polled (Pp) bull is bred to a horned cow, what are the chances of having polled offspring.

PP



$\frac{2}{4} = \frac{1}{2} = .5 = 50\%$

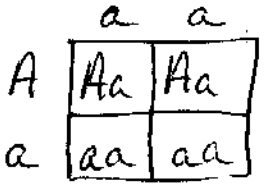
2. In corn having pigment (red or purple) is dominant to have non-pigment (white or yellow). If a homozygous pigmented corn is crossed with a homozygous non-pigmented corn, what is the probability of having white or yellow (non-pigmented) corn? What is the probability of having red or purple (pigmented) corn?



$P(\text{non-pigment}) = \frac{0}{4} = 0 = 0\%$

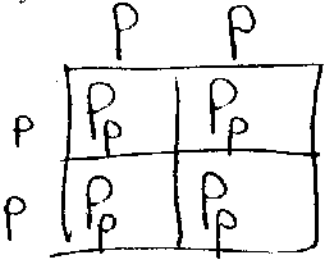
$P(\text{pigment}) = \frac{4}{4} = 1 = 100\%$

3. Albinism in animals is a condition in which the animal does not produce any pigment. This condition is only present when the animal has two recessive alleles for the condition (aa). If an albino deer breeds with a deer that is a carrier of the trait (Aa), what are the chances of them having offspring that are albino?



$\frac{2}{4} = \frac{1}{2} = 50\%$

4. In cats polydactylism (having extra toes) is dominant to having a normal number of toes. If a homozygous polydactyl cat mates with a cat with a normal number of toes, what are the chances of the kittens being polydactyl?



$\frac{4}{4} = 1 = 100\%$

5. In swine erect ears are dominant to drooping ears and mule foot is dominant to normal feet. If an erect-eared, mule-footed sow (EeMm) is bred with a droopy-eared, mule-footed boar (eeMm), what are the chances of the offspring being erect-eared and normal-footed?

	EM	Em	eM	em
eM	EeMM	EeMm	eeMM	eeMm
em	EeMm	Eemm	eeMm	eemm
eM	EeMM	EeMm	eeMM	eeMm
em	EeMm	Eemm	eeMm	eemm

$\frac{2}{16} = \frac{1}{8}$

.125

12.5%

	E	e
e	Ee	ee
e	Ee	ee

$P(\text{erect}) = \frac{1}{2}$

	M	m
M	MM	Mm
m	Mm	mm

$P(\text{normal}) = \frac{1}{4}$

$\frac{1}{2} \cdot \frac{1}{4}$

$\frac{1}{8} = .125 = 12.5\%$

6. In cattle red colored fur is dominant to white colored fur and polled (no horns) is dominant to having horns. If a red, polled (RrHH) bull mates with a white, polled (rrHh) cow, how many possible outcomes are there? What are the chances that the offspring are white and polled? What are the chances that the offspring are red and polled?

	RH	RH	rH	rH
rH	RrHH	RrHH	rrHH	rrHH
rh	RrHh	RrHh	rrHh	rrHh
rH	RrHH	RrHH	rrHH	rrHH
rh	RrHh	RrHh	rrHh	rrHh

$4 \cdot 4 = 16$ possible outcomes

	R	r
r	Rr	rr
r	Rr	rr

$P(\text{white}) = \frac{1}{2}$

$P(\text{red}) = \frac{1}{2}$

	H	H
H	HH	HH
h	Hh	Hh

$P(\text{polled}) = 1$

$P(\text{horns}) = 0$

$P(\text{white \& polled}) = \frac{1}{2} \cdot 1 = \frac{1}{2} = 50\%$

$P(\text{red \& polled}) = \frac{1}{2} \cdot 1 = \frac{1}{2} = 50\%$

7. In chickens having a single comb (C) is dominant to having a rose comb (c) and white colored feathers (W) is dominant to having red colored feathers (w). If a white colored hen with a rose comb (Wwcc) is bred with a red colored rooster with a single comb (wwCc), how many possible outcomes are there? What are the chances that the chicks are red colored with a single comb? What are the chances that the chicks are white with a rose comb?

	Wc	Wc	wc	wc
wC	WwCc	WwCc	wwCc	wwCc
wc	Wwcc	Wwcc	wwcc	wwcc
wC	WwCc	WwCc	wwCc	wwCc
wc	Wwcc	Wwcc	wwcc	wwcc

$4 \cdot 4 = 16$ possible outcomes

	W	w
w	Ww	ww
w	Ww	ww

$P(\text{white}) = \frac{1}{2}$

$P(\text{red}) = \frac{1}{2}$

	C	c
C	Cc	Cc
c	cc	cc

$P(\text{single comb}) = \frac{1}{2}$

$P(\text{rose comb}) = \frac{1}{2}$

$P(\text{red and single comb}) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4} = 25\%$

$P(\text{white \& rose comb}) = \frac{1}{2} \cdot \frac{1}{2} = 25\%$

8. A black colored mare with a pacing gait (Bbtt) is bred by a chestnut colored stallion with a trotting gait (bbTt). What are the chances that the foal is chestnut colored with a trotting gait?

	Bt	Bt	bt	bt
bT	BbTt	BbTt	bbTt	bbTt
bt	Bbtt	Bbtt	bbtt	bbtt
bT	BbTt	BbTt	bbTt	bbTt
bt	Bbtt	Bbtt	bbtt	bbtt

bb

T

	B	b
b	Bb	bb
b	Bb	bb

$P(\text{chestnut}) = \frac{1}{2}$

	t	t
T	Tt	Tt
t	tt	tt

$P(\text{trotting}) = \frac{1}{2}$

$\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4} = 25\%$

9. There are 1,254 students in a high school. There are 320 freshman, 305 sophomores, 295 juniors and the rest are seniors? If all the students are placed in a drawing, what is the probability of selecting a senior?

Seniors 334

$\frac{334}{1254} = \frac{167}{627} = .266 = 26.6\%$

10. Driver's licenses in the state of Michigan are a letter followed by twelve numbers 0-9. How many possible drivers' license numbers can be made?

$26 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$

26,000,000,000,000 OR 2.6×10^{13}

26 trillion

11. If 135 people enter a race, how many ways can first, second, and third place be awarded?

$135 \cdot 134 \cdot 133 = 2{,}405{,}970$

1st 2nd 3rd

12. A die is rolled and a coin is tossed. Find the probability of getting an odd number and tails.

$\frac{3}{6} \cdot \frac{1}{2} = \frac{1}{4}$ or 25%

13. A die is rolled and a card is drawn from a 52-card deck. Find the probability of getting a number less than 3 and a face card (K, Q, J).

1, 2 — 4 suits — 12

$\frac{2}{6} \cdot \frac{12}{52} = \frac{1}{13} = .077 = 7.7\%$

14. A jar contains 4 red marbles, 5 blue marbles, and 6 green marbles. Another jar contains 3 red marbles, 7 blue marbles, and 5 green marbles. A marble is drawn from each jar. What is the probability that both are blue?

P(both blue) $= \frac{5}{15} \cdot \frac{7}{15} = \frac{7}{45} = .156$

$\frac{1}{3} \cdot \frac{7}{15}$ 15.6%

15. A box contains 50 batteries. Twenty of them are dead and another 15 are weak. Three batteries are chosen at random from the box. What is the probability that the third battery is weak, given the first battery is dead and the second is weak?

$\frac{20}{50}$ 1st $\frac{15}{49}$ 2nd $\frac{14}{48}$ 3rd

$\frac{14}{48} = \frac{7}{24}$ OR 29.2%