Learning Genetics Can Be Fun - Solutions

1. Two black dogs could be homozygous black (BB) or heterozygous black (Bb). Yellow must be homozygous, therefore cannot be the same genotype as black.

2. P Cc x Cc
F_1 CC, Cc, Cc, cc both parents are normal but "carry" the allele for CF. One in four children will inherit it.

3. a) P Rr x rr
b) R, r and r, r
F_1 Rr, Rr, rr, rr 1 round:1 wrinkled
F_2 RR, Rr, Rr, rr 3 round:1 wrinkled

4. P Ll x ll
F_1 Ll, Ll, ll, ll 1 long:1 short

5. P T_ x tt
F_1 327 tall: 321 short- almost 1:1 therefore unknown parent must be heterozygous.
Note: homozygous (TT) would give ALL tall plants in F_1.

6. The presence of all smooth in the offspring means smooth is dominant.
P SS x ss
F_1 Ss
F_2 3:1

7. a) P Ss x Ss
F_1 SS, Ss, Ss, ss
b) P S_ x _ _
The female must be heterozygous as she produced non-spotted pups. The unknown male must be homozygous recessive (ss). If he were homozygous dominant, all pups would be spotted. If he were heterozygous, you would expect a 3:1 ratio in pups.

8. (i) P T_ x tt
F_1 tt
(ii) P T_ x tt
F_1 Tt
(iii) P T_ x Tt
F_1 tt

The male must be heterozygous (Tt) to be able to produce both trotters and pacers. If he were homozygous dominant he would produce only trotters.

9. Normal woman Pp (must be heterozygous because father was albino)
Husband pp
Husband's parents both Pp
Children Pp, Pp, pp

10. test cross W_ x ww

11. P Pp x Pp
F_1 PP, Pp, Pp, pp chance of PKU is 1/4

12. P Bb x Bb
F_1 BB, Bb, Bb, bb
a) 1/4 (b) 1/4 (c) 1/2
d) 1 homozygous brown:2 heterozygous brown:1 homozygous blonde
e) 3 brown:1 blonde
f) not possible because blonde (b) is recessive
g) C = curly; c = straight
h) P Cc x cc
F_1 Cc, Cc, cc, cc
i) C, c (j) c, c (k) 0 (l) 1/2 (m) 1/2
n) 1 heterozygous:1 homozygous recessive
o) 1 curly:1 straight
p) No. Straight hair is recessive so individual MUST be homozygous (cc).

13. B - black; b - white; S - short; s - long
a) P BBSs x bbss
F_1 BbSs, Bbss 1 black, short:1 black, long

b) P BbSs x bbss
F_1 BbSs, Bbss, bbSs, bbss 1 black, short:1 black, long: 1 white, short:1 white, long

c) P BBss x BbSs
F_1 BBSs, BBss, BbSs, Bbss 1 black, short:1 black, long

d) i) (a) 1/2 (b) 1/4 (c) 1/2
ii) (a) 1/2 (b) 1/4 (c) 1/2
iii) (a) 0 (b) 1/4 (c) 0

14. B - black; b - white; S - solid; s- spotted

	male		female
a) P	B_S_	x	bbS_
F_1	2 B<u>b</u>S_ , 2 bbS_		

Some white pups so the male must be Bb. The absence of any non-spotted pups suggests that female A is SS but we can't say for sure.

b) P	BbS<u>s</u>	x	B_S_
F_1	bbss	the presence of white, non-spotted pups means that female B must be BbSs	

c) P	BbSs	x	bbss
F_1	bbS<u>s</u> , bbss , B<u>b</u>S<u>s</u> , B<u>b</u>ss		

The genotype of female C can be determined from her phenotype.

15. S^R - round; S^L – long
P S^RS^R x S^LS^L
F_1 S^RS^L, S^RS^L, S^RS^L, S^RS^L
P S^RS^L x S^RS^L
F_2 S^RS^R, S^RS^L, S^RS^L, S^LS^L (incomplete dominance)

16. P S^NS^M x S^NS^M

F_1 S^NS^N, S^NS^M S^NS^M, S^MS^M 25% chance of having homozygous recessive child

17. C^RC^R - chestnut; C^MC^M - cremello; C^MC^R - palomino
P C^MC^R x C^MC^M
F_1 C^MC^M, C^RC^M 1 cremello:1 palomino

18. P F^RF^W x F^RF^W
F_1 F^RF^R, F^RF^W, F^RF^W, F^WF^W
a) ½ pink
b) 1/4 red
c) 1/4 white
d) 1:2:1

19. woman I^B_ x man I^A_
F_1 ii is possible if mother and father were both heterozygous. The facts are inconclusive.

20. P ♂ ii x ♀ I^AI^B
F_1 I^Ai, I^Bi

AB ♀ could produce AB offspring if ♂ were type A, B, or AB; she could never produce type O in F_1 because she always donates either A or B.

21. a) P C^hC^a x C^aC^a
F_1 C^hC^a, C^aC^a 1 himalayan:1 albino

b) P CC^a x $C^{ch}C^a$
F_1 2 C_, C^{ch}_, C^aC^a

c) P $C^{ch}C^{ch}$ x $C^{ch}C^a$
F_1 $C^{ch}C^{ch}$, $C^{ch}C^a$ 1 chinchilla:1 light gray

d) P $C^{ch}\underline{C^h}$ x C^aC^a test cross
F_1 5 $C^h\underline{C^a}$, 5 $C^{ch}\underline{C^a}$

22. note: cc = no purple
P Ppcc x PPCc
gametes Pc, pc PC, Pc
F_1 PPCc, PPcc, PpCc, Ppcc

phenotypes 1 purple, curved: 1 white, straight: 1 purple, curved: 1 white, straight (1:1)

23. a) P CCBB (black) x Ccbb (brown)
F_1 CCBb (black), CcBb (black)

b) P ccBB (albino) x CcBb (black)
F_1 CcBB (black), CcBb (black), ccBB (albino), ccBb (albino)

c) P CcBb (black) x ccbb (albino)
F_1 CcBb (black), Ccbb (brown), ccBb (albino), ccbb (albino)

d) P CcBb (black) x CcBb (black)
F_1 CCBB (black), CCBb (black), CcBB (black), CCbb (brown), CcBb (black), Ccbb (brown), ccBB (albino), ccBb (albino), ccbb (albino)
note: you would get the normal 9:3:3:1 as in any heterozygous dihybrid cross but ccBB, ccBb, and ccbb all combine to give 4 albino (a bit tricky, eh?)

24. a) 4 children
b) A is Dd, B is Dd
c) M is dd, N is dd

25.