Warning: not all of these answers have been carefully checked. If you disagree with one of them, you may be correct

1. (a) r_1/r; r_2/r; $\binom{r_1}{2}/\binom{r}{2}$, $r_1r_2/\binom{r}{2}$, $\binom{r_2}{2}/\binom{r}{2}$.
(b) $(r_1+3r_2)/r$, $4r_1r_2/r^2$, $-4r_1r_2/r^2(r-1)$.
(c) $n(r_1+3r_2)/r$, $4n(n-1)r_1r_2/r^2(r-1)$.

2. (a) Gamma distribution, $\lambda=3/2$, $\alpha=2$. (b) $c=1$, (c) $3/2$, $2\log 2$, $2-3\log 2$.
(d) Let $u=\sqrt{2z}$, $\phi(v)=e^{-v^2/2}/\sqrt{2\pi}$, $\Phi(v)=\int_{-\infty}^{v}\phi(u)du$. Then $f_Z(z)=3(\Phi(2u)-\Phi(u))/2u^3+(4u^3-3)\phi(2u)/u^2-(u^2-3)\phi(u)/2u^2$ (hard!).

3. (a) $1/4$. (b) $1-\Phi((35-25)/(30\sqrt{3}/4))=1-\Phi(0.77)=0.2206$.

4. (a) $\binom{6}{5}p^5(1-p)+\binom{6}{6}p^6$. (b) $\sum_{k=0}^{3}\left[\binom{3}{k}p^k(1-p)^{3-k}\right]^2$. (c) $p(1-p)^3$.

5. (a) $P(\text{Urn } k)=6/11, 3/11, 2/11$ for $k=1,2,3$;
(b) $P(\text{second ball is number } k)=49/66, 13/66, 4/66$ for $k=1,2,3$.

6. $f_Z(z)=0$, $z<0$; $f_Z(z)=z/2-1/6-e^{-3z}/6$, $0\le z<2$; $f_Z(z)=7e^{-3(z-2)}/6-e^{-3z}/6$, $2\le z$.

7. (a) $E[X]=25$, $\mathrm{Var}(X)=25/3$. (b) $\Phi(.69)-\Phi(-1.39)=.6726$. (c) $a=9.13$.

8. (a)

$y\backslash x$	1	2	3	4	5	6	$p_Y(y)$
0	5/36	4/36	3/36	2/36	1/36	0	5/12
1	1/36	2/36	3/36	4/36	5/36	6/36	7/12
$p_X(x)$	1/6	1/6	1/6	1/6	1/6	1/6	

(b) $7/2$, $7/12$, $35/12$, $35/144$, $35/72$.

(c)

z	1	2	3	4	5	6	7
$p_Z(z)$	5/36	5/36	5/36	5/36	5/36	5/36	6/36

9. (i) $13\cdot\binom{12}{2}\cdot 4\cdot 4/\binom{52}{6}$, (ii) $\binom{13}{3}\binom{4}{2}^3/\binom{52}{6}$, (iii) $\binom{13}{2}\binom{4}{3}^2/\binom{52}{6}$, (iv) $\left[\binom{13}{2}\binom{4}{3}^2+13\cdot 12\cdot\binom{4}{4}\binom{4}{2}\right]/\binom{52}{6}$, (v) $8\cdot 4^6/\binom{52}{6}$, (vi) $\binom{13}{6}4^6/\binom{52}{6}$, (vii) $13\cdot 12\cdot 11\cdot\binom{4}{3}\binom{4}{2}\binom{4}{1}/\binom{52}{6}$.

10. $M_X(t)=e^t(e^{nt}-1)/n(e^t-1)$; $E[X]=(n+1)/2$; $\mathrm{Var}(X)=(n^2-1)/12$. Use formulas $\sum_{k=1}^{n}k=n(n+1)/2$, $\sum_{k=1}^{n}k^2=n(n+1)(2n+1)/6$.

11. See the book.

12. $10/73$.

13. (a) $E[X_i]=1-\binom{19N}{10}/\binom{20N}{10}$, $\mathrm{Var}(X_i)=\left(1-\binom{19N}{10}/\binom{20N}{10}\right)\left(\binom{19N}{10}/\binom{20N}{10}\right)$,
$\mathrm{Cov}(X_i,X_j)=E[X_iX_j]-E[X_i]E[X_j]=1-2\binom{19N}{10}/\binom{20N}{10}1+\binom{18N}{10}/\binom{20N}{10}-\left(1-\binom{19N}{10}/\binom{20N}{10}\right)^2$,
$E[X]=20E[X_i]$, $\mathrm{Var}(X)=20\,\mathrm{Var}(X_i)+(20\cdot 19)\,\mathrm{Cov}(X_i,X_j)$.
(b) $X=10$, $E[X]=10$, $\mathrm{Var}(X)=0$. Check: $E[X_i]=1/2$, $\mathrm{Var}(X_i)=1/4$, $\mathrm{Cov}(X_i,X_j)=-1/76$.
(c) $E[X_i]=1-(19/20)^{10}$, $\mathrm{Var}(X_i)=(1-(19/20)^{10})(19/20)^{10}$,
$\mathrm{Cov}(X_i,X_j)=1-2(19/20)^{10}+(18/20)^{10}-(1-(19/20)^{10})^2$,
$E[X]=20E[X_i]$, $\mathrm{Var}(X)=20\,\mathrm{Var}(X_i)+(20\cdot 19)\,\mathrm{Cov}(X_i,X_j)$.
(d) $\binom{19N}{10}/\binom{20N}{10}=\left(\frac{19N}{20N}\right)\left(\frac{19N-1}{20N-1}\right)\cdots\left(\frac{19N-9}{20N-9}\right)\to\left(\frac{19}{20}\right)^{10}$, etc.

14. $(3^{n-1}-2^n+1)/3^{n-1}$.

15. (a) $4/13$; (b) $88/169$.

16. See book or class notes.