ANSWERS

Chapter 7

EXERCISE 7.1

(1) (i) 21 m/s (ii) 15 m/s and 27 m/s

(2) (2)(i) 5sec (ii) 128 ft/s (iii)160 ft/s

(3) (i) 1,2 sec (ii) 34 m (iii) $-6\,m/s^2$, $6\,m/s^2$

(4) 75 units (5) $\frac{1}{2}$ kg/m, $\frac{1}{6}$ kg/m

(6) 20π sq.cm/s (7) 2π km/s (8) $\frac{9}{10\pi}$ m/min

(9) (i) $\frac{-8}{3}$ m/s (ii) 26.83 sq.m/sec (10) 70 km/hr.

EXERCISE 7.2

(1) (i) 7 (ii) ∞ (2) $(1,0)$

(3) $(0,3)$ and $(4,-25)$ (4) $(2,-1)$ and $(-2,1)$

(5) (i) $2x+y=2\,;x-2y=1$ (ii) $2x-y=-2\,;x+2y=4$

(iii) $x-y=0\,;x+y=\pi$ (iv) $4x+2y=5\;;2x-4y=-5$

(6) $12x-y=15;12x-y=-17$ (7) $x+2y=7\,;x+2y=-1$

(8) $(2\cos t)x+(7\sin t)y=14\,;\ (7\sin t)x-(2\cos t)y=45\sin t\cos t$ (9) $\tan^{-1}(3)$

EXERCISE 7.3

(1) (i) not continuous at $x=0$ (ii) not continuous at $x=\frac{\pi}{2}$ (iii) $f(2)\neq f(7)$

(2) (i) $\frac{1}{2}$ (ii) $-2+2\sqrt{2}$ (iii) $\frac{9}{4}$

(3) (i) not continuous at $x=0$ (ii) not differentiable at $x=\frac{-1}{3}$

(4) (i) $\pm\frac{2}{\sqrt{3}}$ (ii) 7

(6) 320 km (8) No. Since $f'(x)$ cannot be 2.5 at any point in $(0,2)$.

EXERCISE 7.4

(1) (i) $e^x=1+\frac{x}{\lfloor 1}+\frac{x^2}{\lfloor 2}+\cdots$ (ii) $\sin x=x-\frac{x^3}{\lfloor 3}+\frac{x^5}{\lfloor 5}-\frac{x^7}{\lfloor 7}+\cdots$

(iii) $\cos x=1-\frac{x^2}{\lfloor 2}+\frac{x^4}{\lfloor 4}-\frac{x^6}{\lfloor 6}+\cdots$

(iv) $\log(1-x)=-\left(x+\frac{x^2}{2}+\frac{x^3}{3}+\frac{x^4}{4}+\cdots\right)$

(v) $\tan^{-1}(x)=x-\frac{x^3}{3}+\frac{x^5}{5}-\frac{x^7}{7}+\cdots$ (vi) $\cos^2 x=1-\frac{2x^2}{\lfloor 2}+\frac{2^3x^4}{\lfloor 4}-\frac{2^5x^6}{\lfloor 6}+\cdots$

(2) $\log x=(x-1)-\frac{1}{2}(x-1)^2+\frac{1}{3}(x-1)^3-\frac{1}{4}(x-1)^4+\cdots$

(3) $\frac{\sqrt{2}}{2}\left(1+\frac{1}{\lfloor 1}\left(x-\frac{\pi}{4}\right)-\frac{1}{\lfloor 2}\left(x-\frac{\pi}{4}\right)^2-\frac{1}{\lfloor 3}\left(x-\frac{\pi}{4}\right)^3+\cdots\right)$

(4) $f(x)=-(x-1)+(x-1)^2$

EXERCISE 7.5

(1) $\frac{1}{2}$ (2) 2 (3) ∞ (4) 1 (5) 0 (6) 0

(7) $\frac{-3}{2}$ (8) 1 (9) e (10) 1 (11) $\frac{1}{\sqrt{e}}$

EXERCISE 7.6

(1) (i) absolute maximum = -1, absolute minimum = -26

(ii) absolute maximum = 16, absolute minimum = -1

(iii) absolute maximum = 9, absolute minimum = $-\frac{9}{8}$

(iv) absolute maximum = $\frac{3\sqrt{3}}{2}$, absolute minimum = 0

(2) (i) strictly increasing on $(-\infty,-2)$ and $(1,\infty)$, strictly decreasing on $(-2,1)$

local maximum = 20 local minimum = -7

(ii) strictly decreasing on $(-\infty,5)$ and $(5,\infty)$. No local extremum.

(iii) strictly increasing on $(-\infty,\infty)$. No local extremum.

(iv) strictly decreasing on $(0,1)$, strictly increasing on $(1,\infty)$. local minimum = $\frac{1}{3}$

(v) strictly increasing on $\left(0,\frac{\pi}{4}\right),\left(\frac{3\pi}{4},\frac{5\pi}{4}\right)$, and $\left(\frac{7\pi}{4},2\pi\right)$.

strictly decreasing on $\left(\frac{\pi}{4},\frac{3\pi}{4}\right)$ and $\left(\frac{5\pi}{4},\frac{7\pi}{4}\right)$. local maximum= $\frac{11}{2}$ at $x=\frac{\pi}{4}$, $\frac{5\pi}{4}$.

local minimum= $\frac{9}{2}$ at $x=\frac{3\pi}{4}$, $\frac{7\pi}{4}$.

EXERCISE 7.7

(1) (i) concave upwards on $(-\infty,2)$ and $(4,\infty)$. Concave downwards on $(2,4)$

Points of inflection $(2,-16)$ and $(4,0)$

(ii) concave upwards on $\left(\frac{3\pi}{4},\frac{7\pi}{4}\right)$. Concave downwards on $\left(0,\frac{3\pi}{4}\right)$ and $\left(\frac{7\pi}{4},2\pi\right)$

Points of inflection $\left(\frac{3\pi}{4},0\right)$ and $\left(\frac{7\pi}{4},0\right)$

(iii) concave upwards on $(0,\infty)$. Concave downward on $(-\infty,0)$

Points of inflection $(0,0)$

(2) (i)local minimum = -2 ; local maximum = 2 (ii)local minimum = $-\frac{1}{e}$

(iii)local minimum = 0 ; local maximum = $\frac{1}{e^2}$

(3) strictly increasing on $(-\infty,-1)$ and $\left(\frac{1}{2},\infty\right)$. strictly increasing on $\left(-1,\frac{1}{2}\right)$

local maximum = 6 , local minimum = $-\frac{3}{4}$

concave downwards on $\left(-\infty,-\frac{1}{4}\right)$; concave upwards on $\left(-\frac{1}{4},\infty\right)$.

point of inflection $\left(-\frac{1}{4},\frac{21}{8}\right)$

EXERCISE 7.8

(1) $6, 6$ (2) $2\sqrt{5}, 2\sqrt{5}$ (3) 50 (4) 100m^2 (5) 9cm , 6cm (6) 1200m

(7) $10\sqrt{2}, 10\sqrt{2}$ (9) $\sqrt{2}r, \frac{r}{\sqrt{2}}$ (10) 6cm , 6cm , 3cm (11) $32\pi, 0$

EXERCISE 7.9

(1) (i) $x=-1, x=1, y=1$ (ii) $x=-1, y=x-1,$ (iii) $y=-3, y=3$

(iv) $y=x-9, x=-3$

EXERCISE 7.10

1	2	3	4	5	6	7	8	9	10
(1)	(2)	(2)	(2)	(1)	(2)	(3)	(4)	(3)	(1)
11	12	13	14	15	16	17	18	19	20
(3)	(4)	(3)	(4)	(2)	(3)	(3)	(1)	(4)	(3)

Chapter 8

Exercise 8.1

1. (i) 3.0074 2. (i) 24.73 (ii) 1.9688 (iii) 2.963
3. (i) $7x-4$ (ii) $\frac{9-4x}{5}$ (iii) $\frac{x+1}{4}$
4. (i)0.0225π cm², (ii) 0.006 cm² (iii) 0.6%
5. (i) Volume decreases by $80\pi\ cm^3$ (ii) Surface area decreases by $16\pi\ cm^2$ 6. 1%

Exercise 8.2

1. (i) $\frac{2(1-2x)^2(8x-7)}{(3-4x)^2}dx$ (ii) $\frac{4}{3}\frac{\cos 2x}{(3+\sin 2x)^{\frac{1}{3}}}dx$ (iii) $e^{x^2-5x+7}[(2x-5)\cos(x^2-1)-2x\sin(x^2-1)]dx$
2. (i) 0.7 (ii) 0.18 3. (i) $\Delta f = 3.125$, $df = 2.0$ (ii) $\Delta f = 0.11$, $df = 0.1$
4. 3.0013029 5. (i) $\frac{6}{\pi}$ cm (ii) $\frac{40}{\pi}\%$ 6. $30\pi\ mm^3$ 7. $0.4\pi\ mm^2$ 8. 8000
9. (i) $\simeq 3$ words (ii) $\simeq 1$ word 10. 5.25π , 4.76% 11. 60 cm^3, 61.2 cm^3

Exercise 8.3

1. $\frac{1}{8}$ 2. 1 4. cos(1)

Exercise 8.4

1. (i) 27, −14 (ii) 11, −4 (iii) 2, 0, 4 (iv) $e^2\left((\log 2)-1\right), e^2(1+\log 8)$
3. $\frac{x^2-y^2}{x^2y}, \frac{y^2-x^2}{y^2x}+3z^2$, 6yz 4. $\frac{3\left(x^2+y^2+z^2\right)}{\left(x^3+y^3+z^3\right)}$
5. (i) e^y+6x , $6y$, xe^y , e^y+6x

(ii) $\frac{-15}{(5x+3y)^2}, \frac{-25}{(5x+3y)^2}, \frac{-9}{(5x+3y)^2}, \frac{-15}{(5x+3y)^2}$ (iii) 3, $2-25\cos 5x$, 0, 3

10. (i) $72x+84y+0.04xy-0.05x^2-0.05y^2-2000$ (ii) 24, −48 , Keeping y constant and increasing x increases profit.

Exercise 8.5

1. $6x-7y-7$ 2. $-(x+20y+16)$ 3. $(2x-y)dx+\left(-x+\frac{1}{2}y\right)dy$

4. $(y+z)dx+(x+z)dy+(y+x)dz$

Exercise 8.6

1. $e^t\left(2e^t\sin t+3\sin^4 t+e^t\cos t+12\sin^3 t\cos t\right)$, 1

2. $\left(1+e^{2t}\right)^2\left[\cos^3 t\left(1+e^{2t}\right)-\sin t\sin 2t\left(1+e^{2t}\right)+6e^{2t}\sin t\cos^2 t\right]$

3. $4e^{2t}$ 4. $-e^{-2t}\left[\sin 2t-\cos 2t\right]$ 5. $18e^{3s}-3e^s\cos s+3e^s\sin s-4\sin s\cos s$, 15

6. $\frac{3e}{1+e^2}+2\tan^{-1}e$, $\frac{e}{1+e^2}$

7. $te^{st^2}\left[t\sin\left(s^2t\right)+2s\cos\left(s^2t\right)\right]$, $\frac{du}{dt}=se^{st^2}\left[2t+\sin\left(s^2t\right)+s\cos\left(s^2t\right)\right]$, $e\left[\sin(1)+2\cos(1)\right]$, $e\left[2\sin(1)+\cos(1)\right]$

8. $3s^3(e^{3t}+s^2e^{-t})$, $3s^2e^t(e^{2t}-5e^{-2t}s^2)$ 9. $2u(1+2v)$, $2\left(u^2-v\right)$, 3, $\frac{-3}{2}$

Exercise 8.7

1. (i) not homogeneous (ii) Homogeneous, deg.3
   (iii) homogeneous, deg.0 (iv) not homogeneous 6. 5

Exercise 8.8

1	2	3	4	5	6	7	8
(2)	(2)	(2)	(4)	(3)	(2)	(4)	(2)
9	10	11	12	13	14	15	
(3)	(1)	(2)	(3)	(2)	(4)	(1)	

Chapter 9

Exercise 9.1

1. 0.6 2. 0.855 3. 0.375

Exercise 9.2

1. (i) $\frac{13}{2}$ (ii) $\frac{25}{3}$

Exercise 9.3

1. (i) $\frac{1}{4}\log\frac{5}{3}$ (ii) $\frac{\pi}{8}$ (iii) $\frac{\pi}{2}-1$ (iv) $e^{\frac{\pi}{2}}$ (v) $\frac{8}{21}$ (vi) $\frac{1}{2}$

2. (i) 0 (ii) π (iii) $\frac{\pi-2}{4}$ (iv) 0 (v) 0 (vi) $\frac{13}{10}$ (vii) $\frac{\pi}{4}$
   (viii) $\frac{\pi}{8}\log 2$ (ix) $\frac{\pi}{2}(\pi-2)$ (x) $\frac{\pi}{8}$ (xi) $\frac{\pi^2}{2}$

Exercise 9.4

1. $\frac{3}{8}-\frac{19}{8}e^{-2}$ 2. $\frac{1}{\sqrt{2}}\left(\frac{\pi}{12}+\frac{1}{9}\right)$ 3. $1+e^{\frac{\pi}{4}}\left[\frac{\pi}{4}-1\right]$ 4. $-\frac{\pi}{4}$

Exercise 9.5

1. (i) $\frac{\pi}{2\sqrt{6}}$ (ii). $\frac{\pi}{6\sqrt{5}}$

Exercise 9.6

1. (i) $\frac{63\pi}{512}$ (ii) $\frac{16}{35}$ (iii) $\frac{5\pi}{64}$ (iv) $\frac{8}{45}$ (v) $\frac{\pi}{32}$ (vi) $\frac{64}{35}$ (vii) $\frac{1}{24}$ (viii) $\frac{1}{60}$

Exercise 9.7

1. (i) $\frac{5!}{3^6}$ (ii) 29 (2) $\frac{1}{8}$

Exercise 9.8

1. 7.5 2. 2 3. 15 4. 36 5. $2\sqrt{2}$ 6. $\log 2$ 7. $\frac{9}{2}$ 8. yes, $\frac{16}{3}$ 9. $\frac{4}{3}$ 10. $\frac{4}{3}\left(4\pi+\sqrt{3}\right)$

Exercise 9.9

1. $\frac{4\pi}{5}$ 2. $\frac{\pi}{4}\left[1-e^{-4}\right]$ 3. 8π 4. $\frac{2\pi}{15}$ 5. $\frac{14}{3}\pi m^3$ 6. $\frac{1000}{3}\pi cm^3$

Exercise 9.10

1	2	3	4	5	6	7	8	9	10
(1)	(3)	(3)	(4)	(4)	(3)	(3)	(3)	(2)	(1)
11	12	13	14	15	16	17	18	19	20
(4)	(2)	(2)	(4)	(4)	(4)	(3)	(4)	(2)	(1)

Chapter 10

Exercise 10.1

1. (i) 1,1 (ii) 3,2 (iii) 2, does not exist (iv) 1, 2 (v) 1,4

(vi) 2,2 (vii) 2,6 (viii) 2, does not exist (ix) 3,1 (x) 1, 1

Exercise 10.2

1. (i) $\frac{dQ}{dt}=kQ$ (ii) $\frac{dP}{dt}=kP(500000-P)$ (iii) $\frac{dP}{dT}=\frac{kP}{T^2}$ (iv) $\frac{dx}{dt}=\frac{2x}{25}+400$ 2. $\frac{dr}{dt}=-k$

Exercise 10.3

1. (i) $\frac{d^2y}{dx^2}=0$ (ii) $\frac{d^2x}{dy^2}=0$ 2. $r^2\left[1+\left(\frac{dy}{dx}\right)^2\right]=\left(x\frac{dy}{dx}-y\right)^2$

3. $x^2+2xy\frac{dy}{dx}-y^2=0$ 4. $2ay''+y'^3=0$ 5. $xy'-2y-2=0$ 6. $xy'^2+xyy''-yy'=0$

7. $\frac{d^2y}{dx^2}=64y$ 8. $xy''+2y'+x^2-xy-2=0$

Exercise 10.4

2. (i) $m=-2$ (ii) $m=2,3$ 3. $2y^2=x+48$

Exercise 10.5

1. $F=(F-kV)e^{\frac{kt}{M}}$ 2. $k^2\left(1-e^{-\frac{2gx}{k^2}}\right)=v^2$ 3. $y=\frac{1-x}{1+x}$

4. (i) $\sin^{-1}y=\sin^{-1}x+C$ (ii) $y\tan^{-1}x=C$ (iii) $\sin\left(\frac{y-1}{x}\right)=a$ (iv) $e^x+e^{-y}+\frac{x^4}{4}=C$

(v) $\left(e^y+1\right)\sin x=C$ (vi) $\sin\left(\frac{x}{y}\right)=e^{nx+c}$ (vii) $3y=-\left(25-x^2\right)^{\frac{3}{2}}+3C$ (viii) $\sin y=e^x\log x+C$

(ix) $\sec y = 2\sin x + C$ (x) $\frac{1}{2}\left[(x+y)+\sin(x+y)\cos(x+y)\right] = x + C$

Exercise 10.6

1. $\sin\left(\frac{y}{x}\right) = \log|Cx|$ 2. $y = Ce^{\frac{x^3}{3y^3}}$ 3. $e^{\frac{x}{y}} = \log|Cy|$ 4. $3x^2y + 2y^3 = C$
5. $xy^2 - x^2y = C$ 6. $C = xe^{\tan\left(\frac{y}{x}\right)}$ 7. $y + 3xe^{\frac{y}{x}} = 3$ 8. $x_0 = \pm\sqrt{3}e$

Exercise 10.7

1. $y = \sin x + C\cos x$ 2. $y = \frac{\sin^{-1}x}{\sqrt{1-x^2}} + C\left(1-x^2\right)^{-\frac{1}{2}}$ 3. $(y+\cos x)x = \sin x + C$
4. $y\left(x^2+1\right) = \frac{x}{2}\sqrt{x^2+4} + \frac{1}{2}\log\left|x+\sqrt{x^2+4}\right| + C$ 5. $xy^2 = 2y^5 + C$
6. $xy\sin x + \cos x = C$ 7. $ye^{\sin^{-1}x} = \frac{e^{2\sin^{-1}x}}{2} + C$ 8. $y\left(\frac{1+\sqrt{x}}{1-\sqrt{x}}\right) = x + \frac{2}{3}x\sqrt{x} + C$
9. $xy + \tan^{-1}y = C$ 10. $y\log x + \frac{\cos 2x}{2} = C$ 11. $2y = (x+a)^4 + 2C(x+a)^2$
12. $y\left(1+x^3\right) = \frac{x}{2} - \frac{\sin 2x}{4} + C$ 13. $4yx = 2x^2\log x - x^2 + 4C$ 14. $x^2y = \frac{x^4}{4}\log x - \frac{x^4}{16} + C$
15. $2x^3y = x^2 + 3$

Exercise 10.8

1. After 10 hours the number of bacteria as 9 times the original number of bacteria.
2. $P = 300000\left(\frac{4}{3}\right)^{\frac{t}{40}}$ 3. $i = Ce^{-\frac{Rt}{L}}$ 4. $v = \frac{10}{e^2}$ 5. $P = 10000e^{0.075}$
6. $\frac{9^{10}}{10^8}$ % of the radioactive element will remain after 1000 years.
7. (i) $65.33°C$ (ii) 51.91 *mts*
8. (i) $T \simeq 151°F$ (ii) $t = 22.523$. She drunk the coffee between 10.22 and 10.30 approximately.
9. $20°$ 10. $x = 100\left(1-e^{\frac{-3t}{50}}\right)$

Exercise 10.9

Q	1	2	3	4	5	6	7	8	9	10
A	(1)	(2)	(3)	(2)	(2)	(3)	(3)	(2)	(2)	(3)
Q	11	12	13	14	15	16	17	18	19	20
A	(3)	(3)	(1)	(1)	(2)	(3)	(2)	(4)	(2)	(4)
Q	21	22	23	24	25					
A	(1)	(1)	(2)	(2)	(1)					

Chapter 11

EXERCISE 11.1

(1)

Values of Random Variable	0	1	2	3	Total
Number of points in inverse image	1	3	3	1	8

(2)

Values of Random Variable	0	1	2	Total
Number of points in inverse image	325	676	325	1326

(3)

Values of Random Variable	0	1	2	3	Total
Number of points in inverse image	4	30	40	10	84

(4)

Values of Random Variable	–20	5	30	Total
Number of points in inverse image	28	48	15	91

(5)

Values of Random Variable	4	5	6	7	8	Total
Number of points in inverse image	1	4	10	12	9	36

EXERCISE 11.2

(1) $f(x)=\begin{cases}\frac{1}{8} & \text{for} \quad x=0,3\\ \frac{3}{8} & \text{for} \quad x=1,2\end{cases}$

(2) (i)

x	2	4	6	8	10	Total
$f(x)$	$\frac{1}{36}$	$\frac{4}{36}$	$\frac{10}{36}$	$\frac{12}{36}$	$\frac{9}{36}$	1

(2) (ii) $F(x)=\begin{cases}0 & \text{for} \quad x<2\\ \frac{1}{36} & \text{for} \quad 2\le x<4\\ \frac{5}{36} & \text{for} \quad 4\le x<6\\ \frac{15}{36} & \text{for} \quad 6\le x<8\\ \frac{27}{36} & \text{for} \quad 8\le x<10\\ 1 & \text{for} \quad 10\le x<\infty\end{cases}$ (iii) $\frac{13}{18}$ (iv) $\frac{31}{36}$

(3) $f(x)=\begin{cases}\frac{1}{4} & \text{for} \quad x=1,3\\ \frac{1}{16} & \text{for} \quad x=0,4\\ \frac{3}{8} & \text{for} \quad x=2\end{cases}$, $F(x)=\begin{cases}0 & \text{for} \quad x<0\\ \frac{1}{16} & \text{for} \quad 0\le x<1\\ \frac{5}{16} & \text{for} \quad 1\le x<2\\ \frac{11}{16} & \text{for} \quad 2\le x<3\\ \frac{15}{16} & \text{for} \quad 3\le x<4\\ 1 & \text{for} \quad 4\le x<\infty\end{cases}$

(4) (i) 8 (ii) $F(x)=\begin{cases}0 & \text{for} \quad x<0\\ \frac{1}{8} & \text{for} \quad 0\le x<1\\ \frac{3}{8} & \text{for} \quad 1\le x<2\\ 1 & \text{for} \quad 2\le x<\infty\end{cases}$ (iii) $\frac{7}{8}$

(5) (i)

x	-1	0	1	2	3
$f(x)$	0.15	0.20	0.25	0.25	0.15

(ii) $P(X<1)=0.35$ (iii) $P(X\ge 2)=0.40$

(6) (i) $\frac{1}{6}$ (ii) $\frac{17}{36}$ (iii) $\frac{5}{6}$

(7) (a)

x	0	1	2	3	4
$f(x)$	$\frac{1}{2}$	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{1}{10}$	$\frac{1}{10}$

(b) $\frac{4}{5}$ (c) $\frac{2}{5}$

EXERCISE 11.3

(1) 4

(2) (i) 0.16 (ii) 0.3 (iii) 0.75

(3) (i) $\frac{1}{400}$

(ii) $F(x)=\begin{cases} 0 & \text{for} \quad x<200 \\ \frac{x}{400}-\frac{1}{2} & \text{for} \quad 200\le x\le 600 \\ 1 & \text{for} \quad x>600 \end{cases}$

(iii) $\frac{1}{2}$

(4) (i) $\frac{1}{3}$ (ii) $1-e^{-\frac{x}{3}}$ (iii) $1-e^{-1}$ (iv) $e^{-\frac{5}{3}}$ (v) $1-e^{-\frac{4}{3}}$

(5) (i) $F(x)=\begin{cases} 0 & x\le -1 \\ \frac{x^2}{2}+x+\frac{1}{2} & -1\le x<0 \\ -\frac{x^2}{2}+x+\frac{1}{2} & 0\le x<1 \\ 1 & 1\le x \end{cases}$ (ii) 0.75

(6) (i) $f(x)=F'(x)=\begin{cases} 0 & x<0 \\ \frac{1}{2}(2x+1) & 0\le x<1 \\ 0 & 1\le x \end{cases}$ (ii) 0.285

EXERCISE 11.4

(1) (i) 2.3 , 2.81 (ii) 1.67 , 0.56 (iii) $\frac{5}{3}, \frac{1}{18}$ (iv) 2,4

(2) $\frac{8}{7}$

x	0	1	2
$f(x)$	$\frac{1}{7}$	$\frac{4}{7}$	$\frac{2}{7}$

(3) 7 , 16

(4) 2 , 1

x	0	1	2	3	4
$f(x)$	$\frac{1}{16}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{16}$

(5) 15 minutes (6) $\frac{1}{3}$ (7) $\frac{1}{2}, \frac{1}{8}$ (8) Loss ₹. 0.50

EXERCISE 11.5

(1) (i) $\frac{160}{729}$ (ii) $210\left(\frac{1}{5}\right)^4\left(\frac{4}{5}\right)^6$ (iii) $\binom{9}{7}\left(\frac{1}{2}\right)^7\left(\frac{1}{2}\right)^2$ (2) (i) $\binom{10}{4}\left(\frac{1}{4}\right)^4\left(\frac{3}{4}\right)^6$ (ii) $1-\frac{3^{10}}{4^{10}}$

(3) (i) 50, 25 (ii) 40, $\frac{100}{3}$ (4) $\frac{270}{1024}$ (5) (i) $1-0.95^{10}$ (ii) $\binom{10}{2}(0.05)^2(0.95)^8$

(6) (i) $\binom{12}{10}(0.9)^{10}(0.1)^2$ (ii) $2.1(0.9)^{11}$ (iii) $1-\left[2.1(0.9)^{11}\right]$

(7) (i) $\binom{18}{x}\left(\frac{1}{3}\right)^x\left(\frac{2}{3}\right)^{18-x}$ (ii) $\binom{18}{3}\left(\frac{1}{3}\right)^3\left(\frac{2}{3}\right)^{15}$ (iii) $1-\frac{20}{3}\left(\frac{2}{3}\right)^{17}$

(8) $\binom{6}{x}\left(\frac{1}{3}\right)^x\left(\frac{2}{3}\right)^{6-x}$, 2, $\frac{2}{\sqrt{3}}$ (9) 1, $\frac{4}{5}$

EXERCISE 11.6

1	2	3	4	5	6	7	8	9	10
(2)	(4)	(2)	(4)	(4)	(2)	(4)	(3)	(2)	(1)
11	12	13	14	15	16	17	18	19	20
(4)	(4)	(1)	(2)	(1)	(1)	(4)	(4)	(2)	(1)

Chapter 12

Exercise 12.1

1. (i) Yes, $*$ is binary on $\mathbb{R}$ (ii) Yes, $*$ is binary on A

   (iii) No, $*$ is not binary on $\mathbb{R}$

2. No, $*$ is not binary on $\mathbb{Z}$ 3. $\frac{-88}{15}$

4. Yes, usual multiplication is binary on A

5. (i) The given operation $*$ is closure and commutative but not associative on $\mathbb{Q}$.

   (ii) Identity does not exist and so inverse does not exist.

6.

$*$	a	b	c
a	b	c	a
b	c	b	a
c	a	a	c

7. No. The given operation is not commutative and associative

8. (i) $A \vee B = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}$ (ii) $A \wedge B = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$

(iii) $(A \vee B) \wedge C = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$ (iv) $(A \wedge B) \vee C = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix}$

10. (i) It is commutative and associative.
    (ii) Identity and Inverse is exist.

Exercise 12.2

1. (i) $\neg p$: Jupiter is not a planet (ii) $p \wedge \neg q$: Jupiter is a planet and India is not an Island.
   (iii) $\neg p \vee q$: Jupiter is not a planet or India is an Island.
   (iv) $p \rightarrow \neg q$: If Jupiter is a planet then India is not an Island.
   (v) $p \leftrightarrow q$ Jupiter is a planet if and only if India is an Island.
2. (i) $\neg p \wedge q$ (ii) $p \vee \neg q$ (iii) $p \wedge q$ (iv) $\neg p$
3. (i) $p \rightarrow q$ is $\mathbb{T}$ (ii) $p \vee q$ is $\mathbb{F}$ (iii) $\neg p \vee q$ is $\mathbb{T}$ (iv) $p \wedge q$ is $\mathbb{F}$
4. (i), (iii) and (iv) are propositions
5. (i) **Converse:** If x and y are numbers such that $x^2 = y^2$ then $x = y$.
   Inverse: If x and y are numbers such that $x \neq y$ then $x^2 \neq y^2$.
   Contra positive: If x and y are numbers such that $x^2 \neq y^2$ then $x \neq y$.
   (ii) **Converse:** If a quadrilateral is a rectangle then it is a square.
   Inverse: If a quadrilateral is not a square then it is not a rectangle.
   Contrapositive: If a quadrilateral is not a rectangle then it is not a square.
6. (i) Truth table for $\neg p \wedge \neg q$

p	q	$\neg p$	$\neg q$	$\neg p \wedge \neg q$
T	T	F	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

(ii) Truth table for $\neg(\neg p \wedge \neg q)$

p	q	$\neg q$	$p \wedge \neg q$	$\neg(\neg p \wedge \neg q)$
T	T	F	F	T
T	F	T	T	F
F	T	F	F	T
F	F	T	F	T

(iii) Truth table for $(p \vee q) \vee \neg q$

p	q	$\neg q$	$p \vee q$	$(p \vee q) \vee \neg q$
T	T	F	T	T
T	F	T	T	T
F	T	F	T	T
F	F	T	F	T

(iv) Truth table for $(\neg p \rightarrow r) \wedge (p \leftrightarrow q)$

p	q	r	$\neg p$	$(\neg p \rightarrow r)$	$p \leftrightarrow q$	$(\neg p \rightarrow r) \wedge (p \leftrightarrow q)$
T	T	T	F	T	T	T
T	T	F	F	T	T	T
T	F	T	F	T	F	F
T	F	F	F	T	F	F
F	T	T	T	T	F	F
F	T	F	T	F	F	F
F	F	T	T	T	T	T
F	F	F	T	F	T	F

7. (i) Contradiction (ii) Tautology (iii) Contingency (iv) Tautology

12. $p \rightarrow (q \rightarrow p)$ is a Tautology.

13. Yes. The statements are logically equivalent.

Exercise 12.3

Choose the appropriate answer from the given distractors.

Q	1	2	3	4	5	6	7	8	9	10
A	(2)	(3)	(2)	(4)	(2)	(2)	(3)	(4)	(3)	(2)
Q	11	12	13	14	15	16	17	18	19	20
A	(4)	(1)	(3)	(3)	(3)	(2)	(4)	(3)	(1)	(4)