

**KEY****Section 1: Algebra**

- 1.1 a,b,c  
 1.2 a,c  
 1.3 b  
 1.4  $(p-1)/2$   
 1.5

$$\begin{bmatrix} 1 & 4 & 3 \\ 0 & 3 & 1 \\ 0 & 0 & 2 \end{bmatrix}$$

1.6

$$\begin{bmatrix} 1 & -2 & 2 & 0 \\ 0 & 1 & -4 & 6 \\ 0 & 0 & 1 & -6 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- 1.7  $x^3 + 6x^2 + 18x + 24$   
 1.8 (a)  $n$ ; (b) 0  
 1.9 a  
 1.10 b,c

**Section 2: Analysis**

- 2.1 b,c  
 2.2  $2f(0)$   
 2.3  $3[f(1/3) - f(0)]$   
 2.4 (a) 0; (b)  $\frac{1}{2} \int_{-\pi}^{\pi} f(t) dt$   
 2.5 (a) Not uniformly convergent; (b) uniformly convergent; (c) not uniformly convergent  
 2.6

$$\frac{2}{x} (e^{x^2} - e^{-x^2})$$

2.7

$$e^{\frac{k(k+1)}{2a}}$$

2.8

$$\frac{1}{4} + \frac{1}{4} \sum_{n=1}^{\infty} (-1)^n (n+1) \left( \frac{z-2}{2} \right)^n$$

- 2.9 0  
 2.10 b

**Section 3: Topology**

- 3.1 b,c  
 3.2 a,b  
 3.3 b,c  
 3.4 a,b  
 3.5 b  
 3.6 b  
 3.7 none  
 3.8 a,c  
 3.9 c  
 3.10 a,c

**Section 4: Applied Mathematics**

- 4.1  $x^2 + 2y^2 = c^2$   
 4.2  $-u'' = f$  on  $]0, 1[$ ;  $u(0) = u(1) = 0$   
 4.3  

$$\begin{aligned} x(t) &= e^t(\cos \omega t - \sin \omega t) \\ y(t) &= e^t(\cos \omega t + \sin \omega t) \end{aligned}$$
  
 4.4  $u(x, t) = (x - bt)^2$   
 4.5  

$$v''(r) + \frac{n-1}{r} v'(r) = 0$$
  
 4.6  

$$L[y](s) = \frac{1+a+s}{s^2+as+b}$$
  
 4.7  $x_{n+1} = \frac{1}{2}(3x_n - ax_n^3)$   
 4.8 b,c  
 4.9 b  
 4.10  $\max z = 21$  at  $x = 3; y = 0$

**Section 5: Miscellaneous**

- 5.1 b,c  
 5.2  $\frac{N}{2}(2a + (N^2 - 1)d)$   
 5.3  $n! - 2(n-1)!$   
 5.4  

$$D_n = n! - 1 - \sum_{k=1}^{n-2} \binom{n}{k} D_{n-k}$$
  
 5.5  $44/120 = 11/30$   
 5.6 a,b,c  
 5.7 a,b,c  
 5.8  

$$\frac{x}{1-x-x^2}$$
  
 5.9 semi-major axis = 1; semi-minor axis =  $1/3$   
 5.10  

$$a + (b-a)e^{-\frac{1}{2}}$$

**Note:**

Accept any correct equivalent form of the answers.