

## KEY

## Section 3: Geometry

### Section 1: Algebra

- 1.1  $4A - 4I$
- 1.2 7
- 1.3 12
- 1.4  $-a_1 + 9a_2 + 5a_3 \neq 0$
- 1.5  $x^4 - 16x^2 + 4$
- 1.6  $G_y = gG_xg^{-1}$
- 1.7 01
- 1.8  $\pm 1$
- 1.9  $\dim(V_0) = 2n; \dim(V_e \cap V_0) = n$
- 1.10  $x = aqm + bpn = aqm + p(1 - am)$  etc.
- 1.11  $\overline{13}$
- 1.12 3
- 1.13 b
- 1.14  $\binom{23}{3} = \frac{23!}{20!3!} = 21.22.23/1.2.3 = 7 \times 11 \times 23 = 1771$
- 1.15 c

### Section 2: Analysis

- 2.1  $e^{-\frac{1}{8}}$
- 2.2  $\frac{\pi}{4}$
- 2.3 (a)  $\delta \leq 2\varepsilon$ ; (c)  $\delta \leq \varepsilon$
- 2.4 a,b,c
- 2.5  $\frac{1.3.5.1}{2.4.6.7}$
- 2.6  $f \equiv 0$
- 2.7 b,c
- 2.8  $4 \leq x < 6$
- 2.9  $\frac{1}{\sqrt{2}} \log(\sqrt{2} + 1)$
- 2.10 Minimum at (3,-1); Min. value = -8  
(can accept either answer)
- 2.11  $(\pm 1, \frac{1}{2})$ ; shortest distance =  $\frac{\sqrt{5}}{2}$
- 2.12  $\int_0^1 \int_y^1 f(x, y) dx dy = \int_0^1 \int_0^x f(x, y) dy dx$
- 2.13  $1 + \omega + \omega^2 + \omega^3 + \omega^4 + \omega^5 + \omega^6 = 0$
- 2.14 b
- 2.15  $\frac{\pi i}{4}$

- 3.1  $x^2 + y = 2$
- 3.2  $r = s = t = 0$
- 3.3 none
- 3.4  $\sqrt{5}(x^2 + y^2) - 20x + 10y = 0; \sqrt{5}(x^2 + y^2) + 20x - 10y = 0$
- 3.5 c
- 3.6 a
- 3.7  $x^2 + y^2 + 2py = 0$
- 3.8  $b \sin \theta x + (a - b \cos \theta)y = ab \sin \theta$
- 3.9 a pair of straight lines
- 3.10  $(-1, 1)$
- 3.11 centre =  $(1, -2)$ ; radius = 2
- 3.12  $\frac{\sqrt{2}}{3}$
- 3.13 (a) strictly convex; (b) convex, but not strictly convex; (c) not convex
- 3.14  $\{(x, y) \mid x \geq 1; 1 - x \leq y \leq x - 1\}$
- 3.15 b