

M.Sc. Test, 2005

KEY

Algebra

1. $a = -4, b = 1$.
2. (a), (b).
3. $N/2$.
4. 6.
5. $x \mapsto e^x$.
6. (b).
7. 3.
8. 1.
9. 0.
10. 0.
11. False.
12. (a).
13. 48.
14. 1.
15. 1.
16. (b).
17. $A^{-1} = \frac{7}{6}I - \frac{1}{6}A^2$.
18. $b_{11} = 1, b_{22} = 1/3$.
19. (a), (b).
20. $A\mathbf{u} = \mathbf{0}$.

Analysis

1. Yes, $a = 1, b = 0$.
2. $2e$.
3. 1.
4. $0 < \alpha < \infty$.
5. $1/2$.
6. $\log(1 + \sqrt{2})$.
7. (a), (b).
8. \mathbb{R} .
9. 2.
10. 0.
11. $\varepsilon < 1/M$.

12. $2xe^{x^4} - e^{x^2}$.
13. None.
14. -1 .
15. Yes, -1 .
16. Yes, 0.
17. e^x .
18. $f(x) = A \cos x + B \sin x$.
19. $u_x + iv_x$.
20. (a).

Geometry

1. $(x \pm 4)^2 + y^2 = 17$.
2. Ellipse.
3. $(x-1)^2 + (y-1)^2 = 2 \Leftrightarrow x(x-2) + y(y-2) = 0$.
4. 0.
5. (a), (b).
6. $y = \pm h/2$.
7. (a).
8. No.
9. Semi-major = $1/\sqrt{\lambda_2}$, semi-minor = $1/\sqrt{\lambda_1}$.
10. False.
11. $(0, 1), (-1, 0), (1/2, 3/2), (-3/2, -1/2)$.
12. None.
13. (a) Pair of planes; (b) cone.
14. $(3, 1); e = \sqrt{2}$.
15. $(5, 4)$.
16. Pair of (parallel) lines. (Can accept even without the word 'parallel').
17. $\pi/4$.
18. Triangle.
19. $8\pi/3$.
20. 4.