Indian Air Force
Airman Selection Test
(Group 'X' Trade)
Solved Paper
(Based on Memory)

2006

Directions—(Q. 1 to 10) Fill in the blanks with suitable words given below it.

His .... 1 .... talk used to be full of wit and humour over books .... 2 .... a wide range of interests as .... 3 .... as he got them. He had .... 4 .... a standing order to two books-shops............. 5 .... Mumbai to mail him catalogues .... 6 .... all the latest titles. Books would .... 7 .... come to him. .... 8 to the amazement of his friends. He .... 9 .... to set apart a portion .... 10 his salary every month for meeting the cost of these books.

1. (A) Anxious   (B) Enthusiastic
   (C) Fervent   (D) Voracious

2. (A) Including   (B) Covering
   (C) Containing   (D) Barring

3. (A) Soon   (B) Firmly
   (C) Urgently   (D) Quickly

4. (A) Intimated   (B) Given
   (C) Offered   (D) Proclaimed

5. (A) Within   (B) Inside
   (C) At   (D) In

6. (A) For   (B) Of
   (C) From   (D) About

7. (A) Sometimes   (B) Often
   (C) Rarely   (D) Occasionally

8. (A) Least   (B) More
   (C) Most   (D) Much

9. (A) Used   (B) Wanted
   (C) Tried   (D) Liked

10. (A) In   (B) With
    (C) Of   (D) From

Directions—(Q. 11 to 15) Choose the word which is most nearly the same in meaning.

11. GERMINAL—
    (A) Creative   (B) Excused
    (C) Sterilized   (D) Primitive

12. GIST—
    (A) Clift   (B) Summary
    (C) Expostulation   (D) Expedition

13. GLIB—
    (A) Slippery   (B) Fashionable
    (C) Antiquated   (D) Articulate

14. GNOME—
    (A) Fury   (B) Gaint
    (C) Dwarf   (D) Native

15. INCLEMENT—
    (A) Unfavourable   (B) Abandoned
    (C) Kindly   (D) Selfish

Directions—(Q. 16 to 20) Choose the opposite word in meaning.

16. JEREMIAD—
    (A) Prophecy   (B) Proposition
    (C) Praise   (D) Overture

17. JETTISON—
    (A) Salvage   (B) Submerge
    (C) Descend   (D) Dedared

18. JOCULAR—
    (A) Arterial   (B) Bloodless
    (C) Verbose   (D) Serious

19. JUDICIOUS—
    (A) Punitive   (B) Unwise
    (C) Criminal   (D) Illicit

20. KITH—
    (A) Outfit
    (B) Strangers
    (C) Brothers
    (D) Ceramics tool

21. Two lenses of power +6 and −2 diopters are placed in contact. What will the focal length of combination ?
    (A) 0·25 m   (B) 25 m
    (C) 0·50 m   (D) 50 m

22. Which of the following has the maximum frequency ?
    (A) Gamma rays
    (B) Blue light
    (C) Infrared rays
    (D) Yellow light

23. A convex lens (refractive index = 1·5) is dipped in water (refractive index = 1·33), then its power will—
    (A) Increases
    (B) Decreases
    (C) Remains unchanged
    (D) None of these

24. If the focal length of a lens is 'f' metre, then its value of power will be—
    (A) f diopter
    (B) $\frac{1}{f}$ diopter
    (C) $1 - f$ diopter
    (D) None of these

25. If equal focal length 'f' of two convergent lens is placed in contact with each other, then what will be focal length of the combination ?
    (A) f
    (B) $2f$
    (C) $f/2$
    (D) $3f$

26. If the length of 1 Ω resistance wire is doubled by stretch its resistance will be—
    (A) $2\,\Omega$
    (B) $\frac{1}{2}\,\Omega$
    (C) $4\,\Omega$
    (D) $\frac{1}{4}\,\Omega$

27. In electric circuit the potential difference measures in—
    (A) Ampere (A)
    (B) Volt (V)
    (C) Ohm (Ω)
    (D) Watt (W)

28. Kirchhoff's point law obeys—
    (A) The principle of conservation of energy
    (B) The principle of conservation of charge
    (C) The principle of conservation of momentum
    (D) The principle of conservation of mass

29. Electron volt measures—
    (A) Charge
    (B) Potential difference
    (C) Current
    (D) Energy

30. The dimension of electromotive force is—
    (A) $[ML^2T^{-2}]$
    (B) $[I^{-1}ML^2T^{-2}]$
    (C) $[MLT^{-2}]$
    (D) $[I^{-1}ML^2T^{-3}]$

31. The dimension of electrical potential is—
    (A) $[ML^2T^{-3}I^{-1}]$
    (B) $[MLT^{-3}I^{-1}]$
    (C) $[MLT^{-3}I^{-2}]$
    (D) $[ML^2T^{-3}I^{-2}]$

32. A current of 10 ampere and 15 ampere respectively is flowing in two parallel wires in similar direction. The distance between them is 0·3 m. The force applied on 3 m length of wire will be ($\mu_0 = 4\pi \times 10^{-7}$ Hm^{-1})—
    (A) $3 \times 10^{-4}\,N$
    (B) $4 \times 10^{-3}\,N$
    (C) $2 \times 10^{-12}\,N$
    (D) $12 \times 10^{-2}\,N$

33. A coil of wire of radius r has 600 turns and a self inductance of 108 mH. The self inductance of a similar coil of 500 turns will be—
    (A) 60 mH
    (B) 75 mH
    (C) 90 mH
    (D) 105 mH

34. Magnetic flux through a coil depends upon—
    (A) Number of turns
    (B) Area
    (C) Magnetic field
    (D) All of the above

35. The magnetic effect of an electric current was discovered by—
    (A) Flemming
    (B) Faraday
    (C) Ampere
    (D) Oerested

36. By the hot filament the emitted particles in the vacuum tube is known as—
    (A) Proton
    (B) Neutron
    (C) Electron
    (D) Atom

37. The thermal conductivity of a rod depends on—
    (A) Length
    (B) Mass
    (C) Area of cross-section
    (D) Material

38. Boolean expression for OR Gate will be—
    (A) $A + B = C$
    (B) $A \cdot B = 0$
    (C) $\bar{A} = A$
    (D) $C = \overline{AB}$

39. A Jet engine works on principle of—
    (A) The conservation of mass
    (B) The conservation of energy
    (C) The conservation of linear momentum
    (D) The conservation of angular momentum

40. For a complete inelastic collision—
    (A) $e = 1$ (B) $e = 0$
    (C) $e > 1$ (D) $e < 1$

41. If two balls are collide on equal temperature, then conserved physical quantity is—
    (A) Temperature
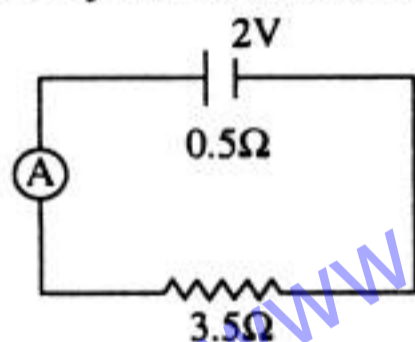   (B) Velocity
    (C) Dynamic energy
    (D) Momentum

42. Parsec is the unit of—
    (A) Force (B) Momentum
    (C) Mass (D) Distance

43. According to astronomer, the approximate time of world's birth is—
    (A) 5×10^9 years
    (B) 0.5×10^9 years
    (C) 15×10^9 years
    (D) 1.5×10^9 years

44. In the circuit shown in figure, the value of current read by ammeter will be—

    (A) 2 A (B) 4 A
    (C) 1 A (D) 0.5 A

45. The electromotive force is measured by which instrument ?
    (A) Ammeter (B) Thermometer
    (C) Voltmeter (D) Voltameter

46. The period of function $y = |\sin x| + |\cos x|$ is—
    (A) $\dfrac{\pi}{2}$ (B) 2π
    (C) 3π (D) π

47. The range of function $y = \dfrac{1}{2 - \cos 3x}$ is—
    (A) $\left[\dfrac{1}{2}, 1\right]$ (B) $\left[\dfrac{1}{3}, 1\right]$
    (C) $\left[1, \dfrac{1}{4}\right]$ (D) $\left[\dfrac{1}{2}, 2\right]$

48. If $f(x) = \dfrac{\sqrt{1 + Px} - \sqrt{1 - Px}}{x}$; $-1 \le x < 0$
    $= \dfrac{2x + 1}{x - 2}$; $0 \le x \le 1$
    is continuous in the interval of $[-1, 1]$ then $P = ?$
    (A) 1 (B) $-\dfrac{1}{2}$
    (C) $\dfrac{1}{2}$ (D) -1

49. If $x = \sqrt{\dfrac{\pi}{2}}$, the derivative value of $\cos (\sin x^2)$ is—
    (A) 1 (B) 2
    (C) $\dfrac{1}{2}$ (D) 0

50. If $x = \log t$ and $y = t^3 - 1$, then the value of y'' at $t = 1$ is—
    (A) 1 (B) 2
    (C) 4 (D) 3

51. For a cycloid $x = a(\theta - \sin \theta)$, $y = a(1 - \cos \theta)$ the point value of normal at $\theta = \pi/2$ will be—
    (A) -1 (B) $\dfrac{1}{2}$
    (C) 2 (D) -2

52. Maximum value of $\sin x + \cos x$; $0 < x < \dfrac{\pi}{2}$ is—
    (A) 1 (B) -1
    (C) $\sqrt{2}$ (D) $\dfrac{2}{3}$

53. $\displaystyle\int e^{\tan^{-1} x} \left[\dfrac{1 + x + x^2}{1 + x^2}\right] dx = ?$
    (A) $xe^{\tan^{-1} x} + k$ (B) $e^{\tan^{-1} x} + k$
    (C) $xe^{\tan x} + k$ (D) None of these

54. $\displaystyle\int_0^1 \log \left(\dfrac{1}{x} - 1\right) dx = 0$ is—
    (A) True (B) False

55. If $f(x)$ be a continuous function and $f(0) = 0$, then $\displaystyle\lim_{x \to 0} \int_0^x \dfrac{f(t)\, dt}{x} = ?$
    (A) 1 (B) -1
    (C) 2 (D) 0

56. If the points $2\hat{i} + 3\hat{j} + 4\hat{k}$; $\hat{i} - 3\hat{j} + \lambda\hat{k}$; $-9\hat{j} + 6\hat{k}$ are collinear, then $\lambda = ?$
   (A) 2   (B) 3
   (C) 5   (D) 6

57. If $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$; $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{c} = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$ are Coplaner, then the value of λ is—
   (A) 2   (B) $\frac{1}{3}$
   (C) -2 (D) -4

58. If $\vec{a} \cdot (\vec{b} \times \vec{c})$, then $(\vec{a} \times \vec{b}) \cdot (\vec{a} \times \vec{c})$ is equal to—
   (A) $\vec{a}^2(\vec{b} \cdot \vec{c})$ (B) $\vec{b}(\vec{c} \cdot \vec{a})$
   (C) $\vec{c}^2(\vec{a} \cdot \vec{b})$ (D) None of these

59. If the value for non zero vectors $\vec{X}$ are $\vec{X} \cdot \vec{A} = 0$, $\vec{X} \cdot \vec{B} = 0$ and $\vec{X} \cdot \vec{C} = 0$, then $[\vec{A}\ \vec{B}\ \vec{C}] = 0$
   (A) True   (B) False

60. If the initial velocity of any particle be 40 cm/sec. and the final velocity be 5 cm/sec. then the distance travelled by the particle in 10th second of its motion will be—
   (A) 85 cm   (B) 86 cm
   (C) 87 cm   (D) 87·5 cm

61. Four coins are tossed, find the probability of getting two heads—
   (A) $\frac{1}{2}$ (B) $\frac{3}{8}$
   (C) $\frac{5}{3}$ (D) 2

62. The opposite combination ratio of an event is $p : q$, then probability of an event is—
   (A) $\frac{q}{p}$ (B) $\frac{q}{p} + 1$
   (C) $\frac{q}{p} + q$ (D) $\frac{p}{q} + p$

63. If $\tan\alpha = \frac{m}{m-1}$ and $\tan\beta = \frac{1}{2m-1}$, then $\alpha + \beta = ?$
   (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{3}$
   (C) $\frac{\pi}{6}$ (D) $\frac{5\pi}{12}$

64. In a ΔABC, if D is the mid-point of BC and AD is perpendicular to AC then—
   (A) $3b^2 = a^2 - c^2$ (B) $3a^2 = b^2 - 3c^2$
   (C) $b^2 = a^2 - c^2$ (D) $a^2 + b^2 = 5c^2$

65. If $\sin\left[\sin^{-1}\frac{1}{5} + \cos^{-1}x\right] = 1$, then x is equal to—
   (A) 0   (B) $\frac{4}{9}$
   (C) $\frac{1}{5}$ (D) 1

66. The co-ordinates of ends of diameter of the circle is $(1, 5)$ and $(6, 7)$ respectively, then the co-ordinate of the centre of the circle is—
   (A) $(4, 1)$ (B) $(6, 35)$
   (C) $\left(\frac{7}{2}, 6\right)$ (D) $\left(\frac{7}{2}, -6\right)$

67. The equation of the normal to the circle $x^2 + y^2 - 4x - 8y = -3$ at the point $(1, 0)$ is—
   (A) $4x + y - 4 = 0$ (B) $x - 4y + 1 = 0$
   (C) $x + 4y + 1 = 0$ (D) $4x - y - 4 = 0$

68. If $y^2 = 8x$ represent parabola, then the focus of parabola will be—
   (A) $(0, 2)$ (B) $(0, 0)$
   (C) $(2, 0)$ (D) None of these

69. The length of the conjugate axis of the hyperbola equation $16x^2 - 3y^2 - 32x - 12y - 44 = 0$ will be—
   (A) 7   (B) 8
   (C) 5   (D) 10

70. The vertices of hyperbola are at $(\pm 5, 0)$ and its foci are at $(\pm 7, 0)$ then its equation will be—
   (A) $\frac{x^2}{24} + \frac{y^2}{25} = 0$ (B) $\frac{x^2}{25} + \frac{y^2}{24} = 2$
   (C) $\frac{x^2}{25} + \frac{y^2}{24}$ (D) None of these

Answers with Explanation

1. (C)   2. (B)   3. (A)   4. (B)   ·5. (D)
6. (B)   7. (B)   8. (D)   9. (A)   10. (C)
11. (A)   12. (B)   13. (D)   14. (C)   15. (A)
16. (C)   17. (A)   18. (D)   19. (B)   20. (B)

21. (A) Powers of first lens $P_1 = +6D$

Powers of second lens $P_2 = -2D$

If the power of combination be P, then

$$P = P_1 + P_2$$
$$= 6 - 2 = +4D$$
$$\text{Focal length} = \frac{1}{P}$$
$$= \frac{1}{4} = 0.25 \text{ m}$$

22. (A)   23. (B)   24. (B)   25. (C)   26. (C)
27. (B)   28. (B)   29. (D)   30. (D)

31. (A) $\text{Electrical Potential} = \dfrac{\text{Work}}{\text{Charge}}$

$$= \frac{[ML^2T^{-2}]}{[IT]}$$
$$= ML^2T^{-3}I^{-1}$$

32. (A) The force applied on wire

$$F = \frac{\mu_0}{4\pi} \times \frac{2I_1I_2I}{r}$$
$$= \frac{4\pi \times 10^{-7}}{4\pi} \times \frac{2 \times 10 \times 15 \times 3}{0.3}$$
$$= 3 \times 10^{-4} \text{ N}$$

33. (B) $\because L_1 = \dfrac{\mu_0 N_1^2 \pi r}{2}$

$$L_2 = \frac{\mu_0 N_2^2 \pi r}{2}$$
$$\therefore \quad \frac{L_2}{L_1} = \left(\frac{N_2}{N_1}\right)^2$$

or, $L_2 = 108 \text{ mH} \times \left(\dfrac{500}{600}\right)^2$

$$= 108 \times \frac{25}{36} \text{ mH}$$
$$= 75 \text{ mH}$$

34. (D)   35. (D)   36. (C)   37. (D)   38. (A)
39. (C)   40. (B)   41. (D)   42. (D)   43. (C)
44. (D)   45. (C)

46. (A) $\because y\left(x + \dfrac{\pi}{2}\right) = \left|\sin\left(x + \dfrac{\pi}{2}\right)\right|$

$$+ \left|\cos\left(x + \frac{\pi}{2}\right)\right|$$
$$= |\cos x| + |(-\sin x)|$$
$$= |\cos x| + |\sin x|$$
$$= y(x)$$

Therefore the period of y is $\dfrac{\pi}{2}$

47. (B) $\because -1 \le \cos 3x \le 1 \Rightarrow 1 \ge -\cos 3x \ge -1$

$$\Rightarrow 3 \ge 2 - \cos 3x \ge 1$$
$$\Rightarrow \frac{1}{3} \le \frac{1}{2 - \cos 3x} \le 1$$

Hence the range of $\dfrac{1}{2 - \cos 3x} = \left[\dfrac{1}{3}, 1\right]$

48. (B) $f(x) = \displaystyle\lim_{x \to 0} \dfrac{\sqrt{1 + Px} - \sqrt{1 - Px}}{x}$

$$\times \frac{\sqrt{1 + Px} + \sqrt{1 - Px}}{\sqrt{1 + Px} + \sqrt{1 - Px}}$$
$$= \lim_{x \to 0} \frac{(1 + Px) - (1 - Px)}{(\sqrt{1 + Px}) + (\sqrt{1 - Px})}$$
$$= \lim_{x \to 0} \frac{2P}{\sqrt{1 + Px} + \sqrt{1 - Px}} = P$$

When $x = 0$, $f(x) = -\dfrac{1}{2}$

$\therefore$ if at $x = 0$, $f(x)$ is continuous then $P = -\dfrac{1}{2}$

49. (D) Let $y = \cos(\sin x^2)$

$$\Rightarrow \quad \frac{dy}{dx} = -\sin(\sin x^2) \times \cos(x^2) \times 2x$$
$$= -2x \times \cos x^2 \times \sin(\sin x^2)$$

Hence,

at $\quad x = \sqrt{\dfrac{\pi}{2}}$

$$\therefore \quad \frac{dy}{dx} = -2\sqrt{\frac{\pi}{2}} \cdot \cos\left(\frac{\pi}{2}\right) \cdot \sin\left(\sin\frac{\pi}{2}\right)$$
$$= -2\sqrt{\frac{\pi}{2}} \times 0 \times \sin 1$$
$$= 0$$

50. (C) $\because \dfrac{dy}{dt} = 2t$ and $\dfrac{dx}{dt} = \dfrac{1}{t}$

$$\therefore \quad \frac{dy}{dx} = \frac{\dfrac{dy}{dt}}{\dfrac{dx}{dt}}$$
$$\Rightarrow \quad y' = \frac{2t}{\dfrac{1}{t}}$$
$$= 2t^2$$
$$\Rightarrow \quad \frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right)$$

$$\Rightarrow \quad y'' = \frac{d}{dt}\left(\frac{dy}{dx}\right) \cdot \frac{dt}{dx}$$

$$= \left[\frac{d}{dt} \cdot (2t^2)\right] \cdot t$$

$$= 4t^2$$

Hence, at $t = 1$, $y'' = 4 \times 1^2 = 4$

51. (A) $\because \quad \dfrac{dx}{d\theta} = a(1 - \cos\theta)$ and $\dfrac{dy}{d\theta} = a\sin\theta$

$$\therefore \quad \frac{dy}{dx} = \frac{\sin\theta}{1 - \cos\theta}$$

$$= \frac{2\sin\frac{\theta}{2} \cdot \cos\frac{\theta}{2}}{2\sin^2\frac{\theta}{2}}$$

$$= \cot\frac{\theta}{2}$$

$$\Rightarrow \left(-\frac{dx}{dy}\right) = -\tan\frac{\theta}{2}$$

$$\therefore \text{ At } \quad \theta = \frac{\pi}{2},$$

$$\left(-\frac{dx}{dy}\right) = -1$$

Hence the required slope of the normal $= -1$

52. (C) $f(x) = \sin x + \cos x$

$$= \sqrt{2}\left[\frac{1}{\sqrt{2}}\sin x + \frac{1}{\sqrt{2}}\cos x\right]$$

$$= \sqrt{2}\left[\sin x \cdot \cos\frac{\pi}{4} + \cos x \cdot \sin\frac{\pi}{4}\right]$$

$$= \sqrt{2}\sin\left\{x + \frac{\pi}{4}\right\}$$

Since $\left\{\sin\left(x + \frac{\pi}{4}\right)\right\} \le 1$

$$\therefore \quad |f(x)| \le \sqrt{2}$$

$$\therefore \text{ Maximum value of } f(x) = \sqrt{2}$$

53. (A) Let, $\tan^{-1} x = u$

$$\Rightarrow \quad x = \tan u$$

$$\Rightarrow \quad \frac{1}{1+x^2}dx = du$$

$$\therefore \quad I = \int e^u (1 + \tan u + \tan^2 u)\, du$$

$$= \int e^u (\tan u + \sec^2 u)\, du$$

$$= e^u \tan u + k$$

$$= xe^{\tan^{-1}x} + k$$

54. (A)

55. (D) Differentiating both numerator and denominator by applying L'Hospital Rule,

$$\lim_{x \to 0} \frac{f(x)}{1} = f(0) = 0$$

56. (C) If the three points are collinear then
$$-9\hat{j} + 6\hat{k} = 2\hat{i} + 3\hat{j} + 4\hat{k} + t\{-\hat{i} - 6\hat{j} + (\lambda - 4)\hat{k}\}$$

Now equalise the coefficient of $\hat{i}, \hat{j}, \hat{k}$, on both sides.

$$0 = 2 - t, \ -9 = 3 - 6t \text{ and } 6 = 4 + t(\lambda - 4)$$

$$\because \qquad 6 = 4 + 2(\lambda - 2) \qquad [\because \ t = 2]$$

$$\Rightarrow \quad 2(\lambda - 4) = 2$$

$$\Rightarrow \quad \lambda - 4 = 1$$

$$\therefore \qquad \lambda = 5$$

57. (D) If the three vectors are coplanar, then

$$\because \qquad \left[\vec{a}\ \vec{b}\ \vec{c}\right] = 0$$

$$\Rightarrow \quad \begin{vmatrix} 2 & -1 & 1 \\ 1 & 2 & -3 \\ 3 & \lambda & 5 \end{vmatrix} = 0$$

$$\Rightarrow \quad 2(10 + 3\lambda) + 1(5 + 9) + 1(\lambda - 6) = 0$$

$$\Rightarrow \qquad 7\lambda + 28 = 0$$

$$\therefore \qquad \lambda = -4$$

58. (A) $\because \qquad \vec{a} \parallel (\vec{b} \times \vec{c})$

$$\Rightarrow \qquad \vec{a} \perp_r \vec{b} \text{ and } \vec{a} \perp_r \vec{c}$$

$$\therefore \qquad \vec{a} \cdot \vec{b} = 0 \text{ and } \vec{a} \cdot \vec{c} = 0$$

Now,

$$(\vec{a} \times \vec{b}) \cdot (\vec{a} \times \vec{c}) = \begin{vmatrix} \vec{a} \cdot \vec{a} & \vec{a} \cdot \vec{c} \\ \vec{b} \cdot \vec{a} & \vec{b} \cdot \vec{c} \end{vmatrix}$$

$$= \begin{vmatrix} \vec{a}^2 & 0 \\ 0 & \vec{b} \cdot \vec{c} \end{vmatrix}$$

$$= \vec{a}^2 (\vec{b} \cdot \vec{c})$$

59. (A)

60. (D) $\because \quad \dfrac{ds}{dt} = v = u + at$

$$\Rightarrow \qquad ds = (u + at) \cdot dt \qquad \ldots(i)$$

Now integrating the above equation (i)

$$\therefore \quad S = \int_9^{10} (u + at)\, dt$$

$$= \left[ut + \frac{1}{2} at^2 \right]_9^{10}$$

$$= u(10 - 9) + \frac{1}{2} a \cdot (10^2 - 9^2)$$

$$= 40 \cdot 1 + \frac{1}{2} \cdot 5 (10^2 - 9^2)$$

$$= 87 \cdot 5 \text{ cm}$$

61. (B) Here total number of elements in the sample space 'S', $n(S) = 2^4$

   [Because there are two sides in every coin]
   If the favourable event of two heads

$$= \text{A, then}$$

$$n(A) = {}^4C_2$$
$$= 6$$

Hence,

required probability $P(A) = \dfrac{n(A)}{n(S)}$

$$= \frac{6}{2^4} = \frac{3}{8}$$

62. (C) We know that if odds against E $= p : q$

   then, $\qquad P(E) = \dfrac{q}{p} + q$

   Hence, required probability $= \dfrac{q}{p} + q$

63. (A)   64. (A)   65. (C)   66. (C)   67. (D)

68. (C)   69. (B)   70. (C)

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