

**E****Bangladesh Marine Academy****52 Batch Cadet Selection Examination: 9 October 2015**

Duration: 2 hours

Full Marks: 320

Roll Number: _____

Mathematics

1. If A & B are any two sets, $(A-B) \cap B = ?$ (A) A, (B) B, (C) ϕ , (D) ϕ
2. If ω is a cube root of unity, $(-1 + \omega + \omega^2)(1 + \omega - \omega^2) = ?$
(A) 4, (B) $4\omega^2$, (C) -4, (D) $-4\omega^2$
3. What is the value of $\tan(-1125^\circ)$? (A) 1, (B) -1, (C) 0, (D) ∞
4. The area of a triangle whose vertices are (1,0), (2,1) & (4,5) in sq. unit?
(A) 1, (B) -1, (C) 0, (D) 2
5. What is the length of line $x/3 + y/3 = 1$, intercepted by between the axes of coordinates is? (A) 3, (B) $\sqrt{2}$, (C) $3\sqrt{2}$, (D) $2\sqrt{3}$
6. The length of the intercept from the x-axis of the circle $x^2 + y^2 + 2x + 2y + 1 = 0$ is (A) 1, (B) 0, (C) 2, (D) 4
7. If $y = 5x^4 - 2x^3 + 7x^2 - x + 9$ then $y_4 = ?$ (A) 0, (B) 60, (C) 120, (D) 240
8. A train moves through a distance $2t^2 + 3t + 4$ meter in t seconds; what will be its velocity (m/s) after 5 minutes? (A) 300, (B) 1200, (C) 1203, (D) 1197
9. $\int_1^e x e^{x^2} dx = ?$ (A) $2(e-1)$, (B) $2(e+1)$, (C) $\frac{1}{2}(e+1)$, (D) $\frac{1}{2}(e-1)$
10. Which one is correct for $(.1)_{10}$?
(A) $(.0001)_2$, (B) $(.00011)_2$, (C) $(.0001100)_2$, (D) $(.00011001)_2$
11. The decimal number 45 into binary number is
(A) 101001, (B) 101101, (C) 110000, (D) 100001
12. If ${}^n P_4 = 14 \cdot {}^{n-2} P_3$, then find the value of n.
(A) 7 or 8, (B) 9, (C) 8, (D) None
13. If $5x + 13 = 31$, what is the value of $\sqrt{5x + 31} = ?$
(A) 13, (B) $\sqrt{13}$, (C) 169, (D) 7
14. If $2A = 3B = 4C$, then A:B:C is: (A) 3:4:6, (B) 6:4:3, (C) 2:3:4, (D) 4:3:2
15. Rewrite the inequality $-6 < x < 2$ using absolute value sign.
(A) $|2x + 4| < 8$, (B) $|2x + 4| > 8$, (C) $|2x - 4| < 8$, (D) None
16. If $s = t^3 - 2t^2 + t - 7$, find the value of ds/dt at $t = -1$.
(A) 6, (B) 7, (C) 8, (D) None
17. Determine $\int \tan x dx$. (A) $\text{Insec}x$, (B) \sec^2x , (C) $\sec x \tan x$, (D) $\text{Intan}x$
18. Find the area inside the parabola $y^2 = 4x$ & straight line $y = x$.
(A) $1/2$, (B) $3/4$, (C) 6, (D) $8/3$
19. Find the equation of the straight line when it passes through the origin and the point (-4,4).
(A) $2x + 3y = 0$, (B) $x = 0$, (C) $y = 0$, (D) $x + y = 0$
20. The costing price of 12 articles is equal to selling price of 9 articles; find the gain percentage. (A) 25%, (B) 30%, (C) 33.33%, (D) 50%
21. If each side of a cube is doubled then its volume will be:
(A) 2 times, (B) 4 times, (C) 6 times, (D) 8 times.
22. The average of 7 consecutive numbers is 33. The largest number will be: (A) 28, (B) 30, (C) 33, (D) 36.
23. What is the average of 2^{10} and 2^{20} ?
(A) 2^{15} , (B) $2^5 + 2^{10}$, (C) $2^9 + 2^{19}$, (D) 2^{29}
24. If $\sin\theta + \cos\theta = 1$, then $\theta = ?$ (A) $2n\pi$, (B) $(4n-1)\pi/2$, (C) $(4n-2)\pi/2$, (D) None.
25. What is the square root of $2i$? (A) $\pm(1-i)$, (B) $\pm i$, (C) $\pm(1+i)$, (D) None
26. Convert $\sin\theta$ into $\cot\theta$.
(A) $1/\sqrt{1+\cot^2\theta}$, (B) $1/\sqrt{2+\cot^2\theta}$, (C) $\pm 1/\sqrt{1+\cot^2\theta}$, (D) None.
27. $\sin A + \sin B + \sin C = ?$ (A) $1/R$, (B) $2S/R$, (C) S/R , (D) None.
28. For what value of x the slope of the curve $y = x + 1/x$ will be zero.
(A) ± 3 , (B) $1/2$, (C) ± 1 , (D) $-1/2$
29. Determine the equation of horizontal Tangent of $y = e^x + e^{-x}$.
(A) $y = -3$, (B) $y = 1$, (C) $x = 2$, (D) $y = 2$
30. The summation of x & y is 100. What would be the minimum magnitude of $x^2 + y^2$. (A) 1000, (B) 5000, (C) 100, (D) 10
31. Determine the highest value of $y = x^2(1-x)$.
(A) $2/27$, (B) $\sqrt{x}/27$, (C) $x/27$, (D) $4/27$
32. If $y = (2x-5)^3$, then what is the value of $y_n = ?$ (A) 48, (B) 24, (C) 64, (D) 0
33. $d^{100}/dx^{100}(x^{99}) = ?$ (A) $100i$, (B) $99i$, (C) $99ix$, (D) None.
34. $\sqrt{i} + \sqrt{-i} = ?$ (A) $\sqrt{2}$, (B) $2i$, (C) 2, (D) None
35. Find the square root of $-8 - 6\sqrt{-1}$.
(A) $\pm(1-i3)$, (B) $\pm(1+i3)$, (C) $(3+i)$, (D) $(3-i)$
36. $\sin x(1 + \cos x)$ will be highest, if:
(A) $x = \pi/3$, (B) $x = \pi/6$, (C) $x = 3\pi/4$, (D) $x = \pi/2$
37. What is the highest height if the maximum range is R?
(A) $R/5$, (B) $R/3$, (C) $1/R$, (D) $R/4$
38. If $\sqrt{2}P = 1+i$, then $P^6 + P^4 + P^2 + 1 = ?$ (A) -1, (B) 1, (C) 0, (D) None
39. Which of the followings is the condition of inverse symmetric matrices? (A) $A = -A'$, (B) $A = A'$, (C) $A = +A'$, (D) All
40. Three vertices of a parallelogram are (1,3), (2,0) & (5,1); then the 4th vertex will be: (A) (3,3), (B) (4,4), (C) (4,0), (D) (0,-4)
41. The points on the parabola $y^2 = 12x$, whose focal distance is 4, are:
(A) $(2, \sqrt{3})$, $(2, -\sqrt{3})$ (B) $(1, 2\sqrt{3})$, $(1, -2\sqrt{3})$, (C) (1,2), (D) None
42. When $\cot\theta = \cot\alpha$ then, $\theta = ?$

1/ $n\pi+\alpha$, (B) $n\pi+1/\alpha$, (C) $2n\pi+\alpha$, (D) $n\pi+\alpha$

43. If $y=\tan^{-1}x$, then $d^2y/dx^2=?$ (A) 1, (B) $\sec n$, (C) 0, (D) $\tan n$
44. Force 7,5,3 acting at a point are in equilibrium. The angle between the forces 5 & 3 is: (A) 120° , (B) 90° , (C) 60° , (D) 30°
45. $(1+i)^8 + (1-i)^8=?$ (A) 2^8 , (B) 2^5 , (C) 2^4 , (D) 2^7
46. One dice & one coin are tossed simultaneously. The probability of getting 6 on dice and head on coin is: (A) $1/2$, (B) $1/6$, (C) $1/12$, (D) None
47. In binary form $11.011+1.10=?$
(A) 10.001, (B) 111.100, (C) 100.111, (D) None
48. The circle $x^2+y^2+2gx+2fy+c=0$ passing through origin:
(A) $f=0$, (B) $g=0$, (C) $c=0$, (D) $x=y$
49. Two circles' radii r_1 & r_2 , condition of contacting each other externally as under when distance between two centres are:
(A) $r_1 > r_2$, (B) $r_2 > r_1$, (C) $r_2 = r_1$, (D) $r_1 + r_2$
50. If tangent of a centre $x=at^2$, $y=2at$ is perpendicular to x axis then its point: (A) (a,a), (B) (0,a), (C) (a,0), (D) (0,0)

Physics

51. The depth of a pond is 12 m. If the refractive index of water is $4/3$, what is the apparent depth? (A) 4.5m, (B) 0.5m, (C) 4.9m, (D) 9m
52. The angle of dip at the pole is: (A) 90° , (B) 0° , (C) 45° , (D) 30°
53. What is the order of molecular range?
(A) 1×10^{-8} m, (B) 10×10^{-9} m, (C) 10×10^{-11} m, (D) 1×10^{-9} m
54. The equation of progressive wave is represented by $y=15 \sin(20t-10x)$. What is the velocity of this wave? (A) 0.75, (B) 0.5, (C) 2, (D) None
55. In which year the solar cell was invented?
(A) 1954, (B) 1964, (C) 1960, (D) 1076
56. At which temperature Helium changes to super-fluid?
(A) 2.41K, (B) 2.29K, (C) 2.17K, (D) 6.07K
57. What is the frequency of a photon of energy 100 MeV?
(A) 4.4×10^{22} Hz, (B) 6.41×10^{22} Hz, (C) 2.41×10^{22} Hz, (D) 8.87×10^{22} Hz
58. What will be the value of acceleration due to gravity g, when the radius of earth is half of the present value? (A) 6g, (B) 2g, (C) 4g, (D) $g/2$
59. What is the value of the earth potential?
(A) 220V, (B) Infinity, (C) 211V, (D) 0V
60. If the sky is cloudy, dews do not form, because the cloud is:
(A) good conductor, (B) bad conductor, (C) heat absorbing, (D) None.
61. What is the effective length of a second pendulum?
(A) 0.093m, (B) 1.993m, (C) 0.993m, (D) 1.094m
62. What is the moment of inertia of a wheel of mass 4 kg and radius of gyration 25 cm?
(A) $25 \text{ kg}\cdot\text{m}^2$, (B) $0.25 \text{ kg}\cdot\text{m}^2$, (C) 0.25 kg^2 , (D) $0.25 \text{ kg}^2\text{m}^2$
63. Which reaction takes place in Hydrogen bomb?
(A) Fission, (B) Fusion, (C) Chemical, (D) Radioactive.
64. The electric field intensity of radio wave is $E_0=10^{-4}\text{Vm}^{-1}$. Find the value of B_0 . (A) $3.33 \times 10^{-13}\text{Wbm}^{-2}$, (B) $3.33 \times 10^{-12}\text{Wbm}^{-2}$, (C) $3.33 \times 10^4\text{Wbm}^{-2}$, (D) $3.33 \times 10^{-4}\text{Wbm}^{-2}$

65. Mechanical practical unit of power is:
(A) Watt, (B) Horse power, (C) Kilowatt, (D) Foot-pound

66. A 200m long train moving with a speed of 36 km/hr passes over a bridge and takes 80 seconds to cross the bridge. How long was the bridge? (A) 400m, (B) 300m, (C) 600m, (D) 450m
67. What will be the length of the minute arm of a watch if the linear speed of the mid-point of the same arm is $1.745 \times 10^{-3} \text{ cm/sec}$?
(A) 1 cm, (B) 3 cm, (C) 4 cm, (D) 2 cm
68. A body of mass 7 kg rests on the floor of a lift. How much be an upward acceleration if the force on body by the floor is 82.6 N?
(A) 4 m/sec^2 , (B) 3 m/sec^2 , (C) 2 m/sec^2 , (D) 5 m/sec^2
69. By a pump of power 980 w, how much Kg of water can be lifted per second to 10m height? (A) 20 kg, (B) 15 kg, (C) 10 kg, (D) 12 kg
70. Which one is the correct formula to find out the radius of earth?
(A) $R=\sqrt{GM/g}$, (B) $R=GM/g$, (C) $R=GM^2/g$, (D) $R=GM/g^2$
71. The maximum force $7.2 \times 10^{-3} \text{ N}$ is applied to lift a needle from the surface of water. Then what is the length of a needle? Surface Tension of water is $72 \times 10^{-3} \text{ Nm}^{-1}$. (A) 4 cm, (B) 2 cm, (C) 5 cm, (D) 3 cm
72. At what temperature the pressure of a gas will be $4 \times 10^5 \text{ Pa}$ if the pressure of a gas at 0°C is $3 \times 10^5 \text{ Pa}$?
(A) 60°C , (B) 91°C , (C) 80°C , (D) 72°C
73. With a battery of how much volts, a capacitor of $3.5 \mu\text{F}$ is charged, so that the amount of energy stored up is $1.75 \times 10^{-4} \text{ J}$?
(A) 12 volts, (B) 20 volts, (C) 7 volts, (D) 10 volts
74. Some bulbs of 100 W each is lighted for 6 hours daily. If the cost of each unit of electricity is Taka 2.50 and bill for 30 days was Tk. 315, then how many bulbs were lighted daily? (A) 5, (B) 7, (C) 10, (D) 4
75. The electrochemical equivalent of copper is $33.34 \times 10^{-8} \text{ kg}\cdot\text{c}$, valency 2 and atomic weight 63.5 then the electrochemical equivalent of hydrogen is: (A) $6.8 \times 10^{-7} \text{ kg}\cdot\text{c}$, (B) $1.05 \times 10^{-8} \text{ kg}\cdot\text{c}$, (C) $3.29 \times 10^{-7} \text{ kg}\cdot\text{c}$, (D) $1.1 \times 10^{-6} \text{ kg}\cdot\text{c}$
76. An electric wire lies along the east-west direction carrying current and due to earth's magnetic field of 10^{-4} T , the force per meter wire is 10^{-3} N , then the wire carries a current: (A) 5 A, (B) 15 A, (C) 10 A, (D) 20 A
77. When a swimming pool is filled with water to 18 ft so that it appears to be half-filled. What is the depth of the pool, when for water $\mu=4/3$?
(A) 36 ft, (B) 27 ft, (C) 30 ft, (D) 24 ft
78. The magnetic field intensity of radio wave is $1 \times 10^{-12} \text{ W/m}^2$ and the velocity of light is $3 \times 10^8 \text{ m/s}$. Then what is the electric field intensity of radio-wave? (A) $2 \times 10^{-5} \text{ V/m}$, (B) $3 \times 10^{-4} \text{ V/m}$, (C) $4 \times 10^{-3} \text{ V/m}$, (D) $2.5 \times 10^6 \text{ V/m}$.
79. The half life of a radioactive element is 6.93 days. It's mean life will be: (A) 8 days, (B) 5.7 days, (C) 10 days, (D) 11.5 days
80. If $K=1.38 \times 10^{-23} \text{ J/k}$, then at what temperature the average kinetic energy of the molecule of Helium gas in a container will be $6.21 \times 10^{-21} \text{ J}$?
(A) 450 K, (B) 300 K, (C) 350 K, (D) 320 K
81. An object having mass of 6 kg is in a static condition. What will be its kinetic velocity 10 seconds after application of 30 N force?
(A) 7,100 J, (B) 7,200 J, (C) 7,400 J, (D) 7,500 J
82. If the length of an wire is 4m, area of cross-section is 0.003 m^2 , breaking stress is $3.267 \times 10^5 \text{ Nm}^2$, then what will be the breaking force of the wire? (A) $9.8 \times 10^2 \text{ N}$, (B) 10^2 kg , (C) 10^2 N , (D) $9.8 \times 10^2 \text{ kg}$

