جامعة بيروت العربية
BEIRUT ARAB UNIVERSITY

Entrance Examination

Faculty of Engineering

General Instructions

1- The First Page of the booklet is the answer sheet. Fold this page along the perforations, slowly and carefully tear off the answer sheet.

2- Write your name and your seat number then fill the seat number in the proper place on the answer sheet.

3- Be sure to fill only one answer with a pencil for each question.

1. Two cars are in a race. The velocity (in km/hr) of the first is $v_1(t) = 5 - t$, and that of the second is $v_2(t) = 3 + t$, where t is the time in hrs. If the race length is 10 km, then the winner is:

A. the second car B. the first car C. both are winners D. none reach the end

2. Which of the following circles circumferences is the nearest to the point (1,2)

A. $x^2 + y^2 = 2$ B. $x^2 + y^2 = 4$ C. $x^2 + y^2 = 16$ D. $x^2 + y^2 = 8$

3. Let $N = a^k + b^m + c^n$ be positive integer, where k, m, n are positive integer numbers. Then N will definitely be an even number whenever

A. a, b, c are even B. a, b, c are odd C. $k + m + n$ are even D. $k + n$ is even.

4. Which is the smallest of the following numbers whenever n approaches zero?

A. $\left(\frac{1}{n} + n\right)^2$ B. $\sin(2n)/n$ C. $e^{(1-\cos(n))}$ D. $(1 + n)^{1/n}$

5. The lines $ax + y = 1$ and $x + by = 1$ intersect at the point (1,1) if:

A. $a = b$ B. a, b are not equal C. $a = b = 1$ D. $a = b = 0$

6. A ball is thrown upward with a velocity given by $\log_n(n) + \ln[e^{(n^2-n)}]$. It reaches a maximum velocity when n equals to

A. 0 B. 1 C. $e^{1/2}$ D. 1/2

7. A box of pens consists of 15 red pens and 30 blue pens. The probability that a person draws two pens of the same color is:

A. 12/2652 B. 4/52 C. 1/240 D. 6/11

8. Two triangles are drawn such that one of their sides is common and the free vertices lie on a line parallel to the common side. The area of the two triangles are:

A. equal B. not equal C. unrelated D. none of these

9. Can a real algebraic equation have an odd number of complex roots?

A. yes B. no C. depending on its order D. only if it is odd

10. Two identical dice are thrown, one after the other. What is the probability that both give odd numbers?

A.1 B. 5/6 C. 1/4 D.1/5

11. Find: $\int 2\,\frac{x\cos(x^2)}{\sin(x^2)}\,dx$

A. $\ln(\sin(x^2)) + c$ B. $\ln(cos(x^2)) + c$ C. $sin\,n(x^2) + c$ D. None of the above

12. A four-side polygon has three out of four of its internal angles each equaling 90^o, then it must be?

A. Obtuse B. Hexagon C. a rectangle or a square D. none of these

13. Find a value for C to make the mean and the mode equal for the following force readings: 10, 11, C, 8, 9, 10, 8, 11, 9, 12, 12

A. 9 B. 10 C. 8 D. 11

14. $\lim_{n\to 0}\left(\frac{\sin(n)}{n} + \cos n\right)^n$

A. 1 B. 0 C. has no limit D. ∞

15. A point is defined by the ordered pair (x, y). The imaginary part of $\frac{x+iy}{x-iy}$ is zero at:

A. $(1,-1)$ B. $(1,2)$ C. $(1,1)$ D. $(0,1)$

16. How many inflection points can be found for a third degreer equation?

A. three B. more than three C. maximum two D. none of these

17. Ten points are chosen from the x-y plane at random such that no point lies on the x-axis. Each point is randomly connected with only two points by straight lines. How many x-axis crossings are there?

A. maximum five B. maximum ten C. maximum nine D. none of these

18. A square and a circle are equal in area. Then the ratio between the square to the circle perimeters is:

A. greater than one B. less than one C. equal one D. none of the above

19. A physics exam was given to three different classes and the average of marks for each class is calculated. Then the higher average means:

A. better students B. easier exam C. worse students D. no relation

20. $\sin(x+\frac{7\pi}{2})$ is equal to:

A. $\sin x$ B. $\cos x$ C. $\sin(x-\frac{7\pi}{2})$ D. none of these

21. Two identical dice are thrown one after one, what is the probability that the sum of the appearing numbers is at least 10?

A. 1/12 B. 1/9 C. 1/6 D. 7/36

22. The integral $\int \frac{ax+b}{x^2+3x}\,dx = \ln(x^2+3x) + c$, if

A. $a = 1, b = 3$ B. $a = 2, b = 3$ C. $a = 2, b = 0$ D. $a = 1, b = 2$

23. How many 3-digit numbers can be formed with the 6 digits 1, 2, 3, 4, 5, 6 if repetitions are not allowed and the first digit must be odd?

A. 55 B. 60 C. 50 D. 45

24. How many packages of 4 different books can be made from 8 Mathematics books and 6 Physics books, if the number of Mathematics books must be always greater than the number of Physics books?

A. 406 B. 320 C. 120 D. none of these

25. A line passing through the origin intersects a circle with center (0,0) at point (3,4) if the radius of the circle is equal to:

A. 2 B. 3 C. 4 D. 5

26. The solution S of $|2x + 1| = |x - 5|$ is

A. $S = \{-6, \frac{4}{3}\}$ B. $S = \{-6, -1\}$ C. $S = \{-\frac{4}{3}, 1\}$ D. $S = \{\frac{1}{6}, -4\}$

27. The two vectors $\vec{a} = < a_1, a_2, a_3 >$ and $\vec{b} = < b_1, b_2, b_3 >$ are perpendicular, if

A. $\vec{a} \times \vec{b} = \vec{0}$ B. $\vec{a} \cdot \vec{b} = 0$ C. $\vec{a}/\vec{b} = -1$ D. $\vec{a}\,\vec{b} = 0$

28. Consider the sets $E = \{-1, 0, 1, 2\}$ and $F = \{-2, 1, 4, 7\}$ and f is the mapping from E to F such that $f = ax + b$. Then f is a bijective function (one to one), if

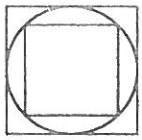
A. $a = .5, b = 2$ B. $a = 0, b = 2$ C. $a = 1, b = 3$ D. $a = 3, b = 1$

29. Which one of the following functions intersects the y-axis at only point (0, 1)?

A. $x^2 + y^2 = 2$ B. $y = \cos x$ C. $y = x^2 - 1$ D. $y = \ln x$

30. Two squares are drawn inside and outside a circle of radius r, as shown. If the area between the two squares is 18 cm^2, then the radius of the circle is

A. $2\ cm$ B. $3\ cm$ C. $1.5\ cm$ D. $2.5\ cm$



31. The integral $\int_a^b \sin x\ dx = 0$, if

A. $a = -b$ B. $a = 0$ C. a = b D. $a = \frac{1}{y}$

32. The integral $\int \frac{x\, e^x - e^x}{x^2}\ dx$, is

A. $x - e^x + c$ B. $\frac{\sin x + e^x}{x} + c$ C. $\frac{e^{-x}}{x} + c$ D. $\frac{e^x}{x} + c$

33. If u(x) is a function of x and v(y) is a function of y, then the derivative of the product of the two functions with respect to the variable x is equal to

A. 0 B. $\dot{u}\,\dot{v}$ C. $\dot{u}\,v$ D. $\dot{u} + \dot{v}$

34. The derivative of $f(x) = e^{[\ln(\cos x) - \ln(\sin x)]}$ at $x = \pi/2$, is

A. $\dot{f}(\pi/2) = -1$ B. $\dot{f}(\pi/2) = 1$ C. $\dot{f}(1) = 1/\sqrt{2}$ D. $\dot{f}(\pi/2) = 0$

35. The function $y = \frac{x^3}{3} - x^2 - 3x + 1$ has two extrema (maxima or minima) points at

A. $x = 1,\ x = 3$ B. $x = -1,\ x = 3$ C. $x = 1,\ x = -3$ D. $x = 0,\ x = 3$

36. The solution of the system $ax + y = 5$, $x^2 + by = 5$ is $x = 1$, $y = 2$, if

A. $a = 1,\ b = 2$ B. $a = 2,\ b = 4$ C. $a = -1,\ b = 1$ D. $a = 3,\ b = 2$

37. The area between a positive function y = f(x) and the x-axis from x = a to x = b, is

A. $f(b) + f(a)$ B. $\int_a^b f(x)\,dx$ C. $\hat{f}(b) - \hat{f}(a)$ D. $\frac{f(b)-f(a)}{2}$

38. $\lim_{x\to 0} \frac{e^x \sin x}{x+\sin x}$ is equal to

A. 1/2 B. ∞ C. 0 D. 1

39. The simple form of $\left(y = \sqrt{(x+2) + 2\sqrt{x+1}} + \sqrt{(x+2) - 2\sqrt{x+1}},\ x \geq 0\right)$, is

A. $\sqrt{x+1}$ B. $2\sqrt{x+1}$ C. $\sqrt{x-1}$ D. $x+3$

40. The equation of the line passing through (-1,3) and (1,2) is

A. $x + y = 2$ B. $x + 2y = 5$ C. $4x + y = 6$ D. $-2x + y = 5$

41. Two points oscillating along the same direction of a propagating wave, vibrate in opposite phase. The distance (d) between these points is: (Consider k as an integer)

A. d= (k+1) λ B. $d = (2k+1)\frac{\lambda}{2}$ C. $d = (k+1)\frac{\lambda}{2}$ D. $d = (2k+1)\lambda$

42. A horizontal force of 40 N is applied for 8 s on a box of mass 10 kg. The box starts moving from rest and travels a distance of 112 m during this period of time. Calculate the constant friction force that affects the box.

A. 15 N B. 35 N C. 5 N D. 3.5 N

43. A sphere has radius 10 cm. The material density of the sphere equals 7000 kg/m^3, the weight of the sphere is

A. $\frac{280\pi}{3}$ N B. $\frac{28\pi}{3}$ N C. 280π N D. 28π N

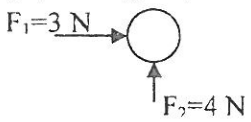
44. Two point charges (q_1=9 μC and q_2) are separated by a distance of 1 m. If the electric field at a point (60 cm from q1 and 40 cm from q2) is zero, find the electric force between the two charges. (The electric constant is given in SI units as k=9×109)

A. 0.162 N, attraction B. 0.324 N, attraction
C. 0.162 N, repulsion D. 0.324 N, repulsion

45. If you have two tuning forks of frequencies 600 Hz and 900 Hz. When the forks vibrate, the difference between their wavelengths is 20 cm. The speed of sound equals

A. 3.6 m/s B. 630 m/s C. 360 m/s D. 6.3 m/s

46. Two forces are applied to a sphere of radius 10 cm with material density (4000 kg/m3). The first force is horizontal and equals 3 N and the second force is vertical and equals 4 N. Calculate the distance travelled by the sphere after 12 s from the start of motion.



A. 125 m B. 135 m C. 2π/135 m D. 135/2π m

47. A cord which is stretched between two points 50 cm apart vibrate with six loops. Take the speed of propagation of the wave along this cord 10 m/s, calculate the frequency of the vibrating motion.

A. 3 Hz B. 40 Hz C. 4 Hz D. 30 Hz

48. A point source emits sound waves in all directions with an average power output of 80 W. Find the intensity at a point 3 m from the source.

A. $\frac{40}{3\pi}$ W/m B. $\frac{40}{9\pi}$ W/m^2 C. $\frac{20}{9\pi}$ W/m^2 D. $\frac{80}{9\pi}$ W/m^2

49. As an ambulance travels down a highway at a speed of 60 m/s, its siren emits sound at a frequency of 400 Hz. What frequency is heard by a standing person when the ambulance is moving away from him? (Take the speed of sound in air 340 m/s)

A. 340 Hz B. 470 Hz C. 400 Hz D. 330 Hz

50. A stone of mass 50 g is released from rest. Find its kinetic energy after 6 s from the beginning of motion.

A. 9 J B. 18 J C. 90 J D. 180 J

51. A particle is projected in air with an initial velocity 90 m/s making an angle 30o with the horizontal. The maximum height for the particle is reached after

A. 9 s B. 4.5 s C. 18 s D. 2.25 s

52. A portion of a conductor of length 12 cm is placed in a uniform magnetic field of magnetite 80 mT. Find the electromagnetic force acting on this portion which carries a current 5 A in direction making an angle 45o with magnetic field direction.

A. $\frac{24}{\sqrt{2}}\ N$ B. $48\sqrt{2}\ mN$ C. $24\sqrt{2}\ mN$ D. $24\ mN$

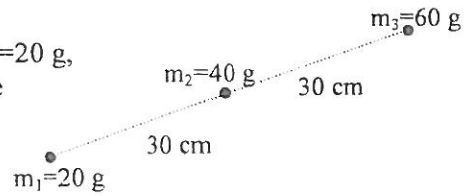
53. The position vector of a moving particle with mass 100 g in the x-y plane is given in meters as :

$$\vec{r}(t) = (3t^2 + 15)\vec{i} + (4t^2 - 10t - 12)\vec{j}$$

Find the resultant force acting on the particle at time t=2 s.

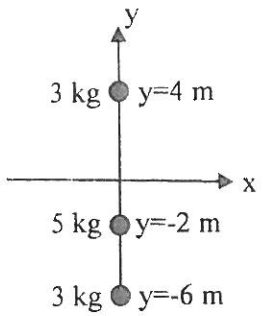
A. 8 N B. 6 N C. 5 N D. 1 N

54. A system consists of three particles of masses (m_1=20 g, m_2=40 g and m_3=60 g) as in fig. The particles are placed on one straight line. Find the position of the center of mass for the system.



A. 40 cm from m_1 B. 20 cm from m_1 C. 30 cm from m_1 D. 5 cm from m_1

55. Three small particles are connected by rigid rods of negligible mass lying along the y-axis as in Fig. If the system rotates about the x axis with an angular speed of 3 rad/s., find the total rotational kinetic energy for the system.



A. 360 J B. 180 J C. 792 J D. 176 J

56. In the longitudinal waves, the direction of vibration in medium of particle is

A. Perpendicular to propagation of wave
B. Parallel to propagation
C. Making an angle 45^{c} with propagation
D. Variable from time to time

57. Two resistors of 2 ohms and 4 ohms are connected in parallel with a battery (10 volts) the power lost in the (4 ohms) resistor is

A. 40 W
B. 10 W
C. 50 W
D. 25 W

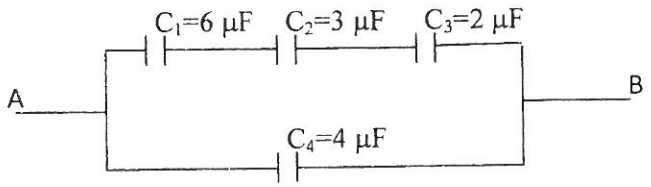
58. A capacitor with capacitance 500 μF is fully charged using a battery 8 V. Calculate the total energy stored in the capacitor.

A. 0.002 J
B. 0.004 J
C. 0.032 J
D. 0.016 J

59. A uniform electric field has a magnitude 400 N/C and is directed in the direction of x-axis. If an electron starts moving from point x= 12 cm, find its kinetic energy when it reaches the origin.

A. 3333.3 eV
B. 48 eV
C. 4800 eV
D. 33.33 eV

60. Four capacitors are connected as in Fig. If a battery 5 v is connected between points A and B, the charge delivered from the battery equals



A. 5 μC
B. 25 μC
C. 75 μC
D. 100 μC

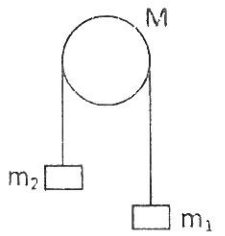
61. An electric resistance R and a capacitor with capacitance C are connected in series with a battery V. If it is desired to decrease the charging time we have to

A. decrease R and C
B. decrease V
C. increase R and C
D. increase V

62. In a certain region of space, the magnetic field is called uniform field, when

A. it has a constant magnitude at all points of this region
B. it is produced from a magnet
C. it affects a wire carrying an electric current
D. it has constant magnitude and direction at all points of this region

63. A Pulley of mass M=4 kg and radius R=5 cm can rotate about a fixed horizontal axis. A mass-less string passes over the pulley and carries two masses m1 and m2 as in Fig. The string does not slide on the pulley. Starting from rest, if mass m1 moves down a distance of 2 m in 5 s, find the angular acceleration of the pulley.



A. 0.032 rad/s^2 B. 0.16 rad/s^2 C. 3.2 rad/s^2 D. 1.6 rad/s^2

64. A point source emits $\pi \times 10^{-3}$ J sound energy each minute. Calculate the sound intensity and the intensity level at a point 10 m from the source. (I_o=10^{-12} the threshold of hearing)

A. $\frac{10^{-6}}{24}\frac{W}{m^2}$, 46 dB
B. $2.5 \times 10^{-6}\frac{W}{m^2}$, 64 dB
C. $\frac{10^{-6}}{24}\frac{W}{m^2}$, 64 dB
D. $2.5 \times 10^{-6}\frac{W}{m^2}$, 46 dB

65. A simple harmonic wave having amplitude A and time period T, is represented by the equation $y = 5 \sin \pi(t + 4)$ meter, then the value of A and T are

A. A=5, T=1 B. A=10, T=1 C. A=5, T=2 D. A=10, T=2

66. A disc with moment of inertia 0.1 kg m^2, rotates about its axis with constant speed 6000 rpm. A braking couple of constant moment of 0.4 N.m. is applied to the disc find the time required for the disc to stop.

A. 3000π sec B. 50π sec C. 50/π sec D. 1500 sec

67. A transformer has 100 turns on its primary and 1000 on its secondary. If a 50 Hz, 100 V output is seen at the secondary, then the

A. frequency at the primary is 5 Hz
B. voltage across the primary is 10 V
C. current on the secondary is 10 times the current in the primary.
D. frequency at the primary is 500Hz

68. A 80 turn circular coil (radius = 10 cm) with a total resistance of 4Ω is placed in a uniform magnetic field directed perpendicularly to the plane of the coil. The magnitude of this field varies with time according to $B = \frac{1}{\pi^2}\sin(50\pi t)$, where B in mT. What is the magnitude of the current induced in the coil at t = 40 ms?

A. 10 mA B. 5 mA C. 20 mA D. 15 mA

69. What is the phase angle between the voltage of the inductor and the voltage of the capacitor in an RLC series circuit?

A. π B. $\frac{3\pi}{2}$ C. $\frac{\pi}{2}$ D. zero

70. Which of the following statements is wrong

A. Sound travels in a straight line
B. Sound travels as waves
C. Sound is a form of energy
D. Sound travels faster in vacuum that then in air

71. What is the molecular weight of a pure gaseous compound having a density of 4.95 g/L at -35° C and 1.34 atm.? (R=0.082 L.atm/K.mole)

A. 24 B. 11 C. 72 D. 120

72. In a reaction, A + B → Product, rate is doubled when the concentration of B is doubled, and rate increases by a factor of 8 when the concentrations of both the reactants (A and B) are doubled, rate law for the reaction can be written as

A. $R=k[A][B]$ B. $R=k[A]^2[B]$ C. $R=k[A][B]^2$ D. $R=k[A]^2[B]^2$

73. A compound of mercury and chlorine once used as a treatment for syphilis (before penicillin was discovered) is composed of 84.98% mercury by mass. Its molecular mass is 472. What is the molecular formula of the compound? (Hg = 200.59, Cl = 35.45)

A. Hg_2Cl_2 B. HgCl C. $HgCl_2$ D. Hg_2Cl_4

74. The pH of a 1 molar solution of a weak acid with a $Ka = 10^{-10}$ will be

A. 2.5 B. 5 C. 7.5 D. 10

75. What is the IUPAC name for $CH_3CHClCH(CH_3)CH_2CH_2CH_2CH_2Br$?

A. 1-bromo-6-chloro-5,6-dimethylhexane
B. 6-bromo-1-chloro-1,2-dimethylhexane
C. 1-bromo-6-chloro-5-methylheptane
D. 7-bromo-2-chloro-3-methylheptane

76. The shape of NH_4^+ is best described by

A. linear B. planar C. pyramidal D. tetrahedral

77. An equilibrium constant of 10^{-4} for a reaction means that the reaction is

A. one that will have 50% product and 50% reactant at equilibrium
B. one that is very favorable and will have mostly product at equilibrium
C. one that is unfavorable and will not have very much product at equilibrium
D. the equilibrium constant only relates to the speed of a reaction and not to the amount of product formed

78. The values of $\Delta_f H^\circ$(298 K) for $SO_2(g)$ and $SO_3(g)$ are –296.8 and –395.7 kJ mol^{-1}. What is the value of $\Delta_r H^\circ$(298 K) per mole of SO_2 for the following reaction?

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$$

A. -98.9 kJ mol^{-1} B. 692.5 kJ mol^{-1} C. 98.9 kJ mol^{-1} D. -692.5 kJ mol^{-1}

79. Given the reaction for the nickel-cadmium battery:
$2NiO(OH) + Cd + 2H_2O \rightarrow 2Ni(OH)_2 + Cd(OH)_2$
What species is oxidized during the discharge of the battery?

A. Ni^{3+} B. Ni^{2+} C. Cd D. Cd^{2+}

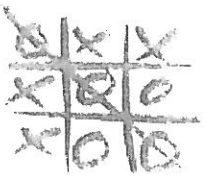
80. 45.0 g of $Ca(NO_3)_2$ was used to create a 1.3 M solution. What is the volume of the solution? (N=14, O=16, Ca=40)

A. 0.21 mL B. 211 mL C. 360 mL D. 4.7 mL

81. What is different among the following?

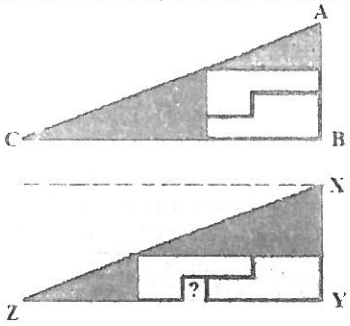
A. Grapes B. Chain C. Solar system D. Ball

82. What is the *minimum* number of picks for two people playing tic-tac-toe until one of them wins?



A. 3 B. 4 C. 5 D. 6

83. We had 4 pieces of paper. We assembled them once and the obtained the shape ABC below. Then, we assembled them again and obtained the shape XYZ. When we compared the two shapes, however, we discovered an empty square (marked by a ?) in the shape XYZ. What is the reason behind that?



A. AC is not a straight line B. AC ≠XZ C. YZ>CB D. None of the above

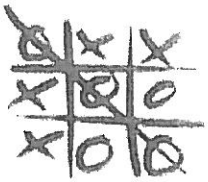
84. In order to cut a round pizza into N equal slices, the number of trips you need to use a rolling knife (each trip goes through the whole diameter) is:

A. N B. 2N C. N/2 D. 2^N

85. Tiles that are 80cm long by 50cm wide shall be used to cover a squared area. What are the dimensions of the minimum possible squared area which will be formed using whole tiles only?

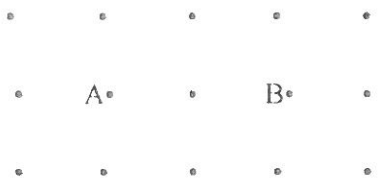
A. 2m x 2m B. 4m x 4m C. 6m x 6m D. 8m x 8m

86. What is the *maximum* number of empty cells in a tic-tac-toe game that remains unpicked for the game to get inconclusive?



A. 1 B. 2 C. 3 D. 4

87. The following grid consists of horizontal and vertical pass-ways only among 15 points. If the shortest path between points A and B takes only two steps, how many horizontal and vertical steps would the longest path take to reach B from A without visiting any point more than once?

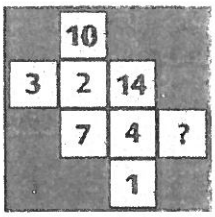


A. 6 B. 9 C. 12 D. 14

88. How many outlets can you get by using 3 single-to-triple adapters like the one below?

A. 5 B. 6 C. 7 D. 9

89. The missing number (marked by ?) is:



A. 8 B. 9 C. 7 D. 6

90. If 6 @ 4 = 210,
5 @ 2 = 37,
7 @ 6 = 113, and
10 @ 6 = 416,

then 15 @ 3 = ?

A. 818 B. 816 C. 1218 D. 818

91. If 5 $3 $ 1 = 1
8 $3 $ 2 = 3
5 $0 $ 0 = 5

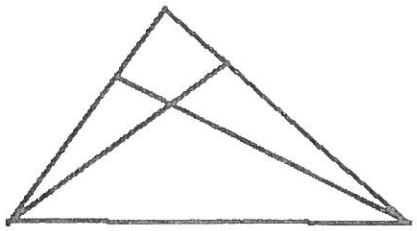
then 3 $ 2 $ 1 = ?

A. 4 B. 2 C. 0 D. 6

92. Consider the odd integers 1, 3, 5, . . . , 101. Which nine of them add up to 250?

A. The nine starting at 25 B. The nine starting at 27 C. The nine starting at 29 D. No nine of them add to 250

93. How many triangles are there?

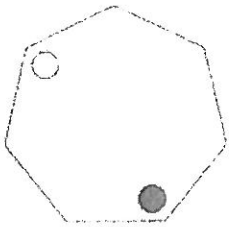


A. 8 B. 9 C. 6 D. 7

94. Which cat is different?

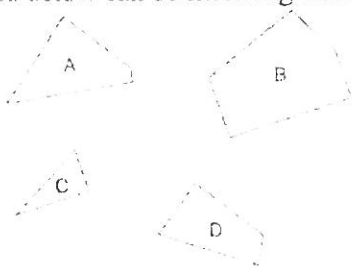
A. 2 B. 3 C. 1 D. All the same

95. In each stage, the black dot in the polygon below moves 3 corners clockwise, and the white dot moves 4 corners anticlockwise. After how many stages will both dots be together at the same corner?



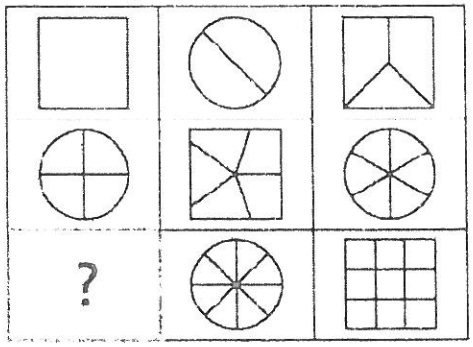
A. 2 B. 3 D. They will never be at the same corner

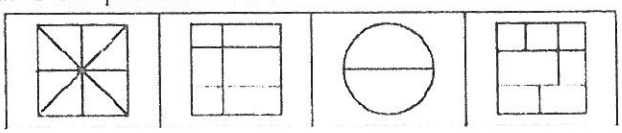
96. Which three of the four pieces below can be fitted together to form a perfect square?



A. A, C, D B. B, C, D C. A, B, C D. A, B, D

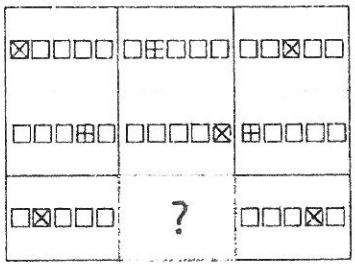
97. Which shape from the four on the right replaces the question mark?

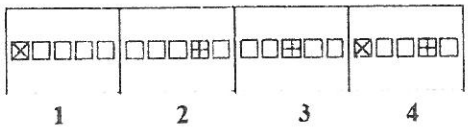




A. 1 B. 2 C. 3 D. 4

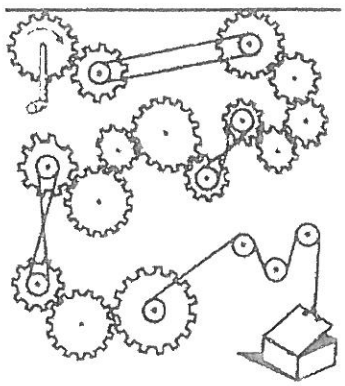
98. Which shape from the four on the right replaces the question mark?





A. 1 B. 2 C. 3 D. 4

99. When the handle is rotated clockwise, as shown, will the box be opened or closed?



A. Opened B. Closed C. Neither D. All of the above

100. Four people witnessed a crime. Each gave a different description of the criminal.
Ahmed: He was average height, thin, and middle-aged.
Samir: He was tall, thin, and middle-aged.
Hany: He was tall, thin, and young.
Waleed: He was tall, of average weight, and middle-aged.
Who is the *most* likely to be accurate?

A. Ahmed B. Samir C. Hany D. Waleed