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Electrical Engineering

Mega Mock Test

(June 03rd - June 04th 2022)

Questions & Solutions

Ans. B

Sol. RCT may be considered as a thyristor with a built in antiparallel diode.

4. Symmetrical component of phase a is $I_{a_0} = 0A, I_{a_1} = 12\angle 30^\circ A, I_{a_2} = 16\angle 90^\circ A$ then what will be the neutral current?

- A. $1.5 \angle 30^\circ A$
- B. $2 \angle 30^\circ A$
- C. $3.12 \angle 12^\circ A$
- D. $0 A$

Ans. D

Sol. We know that Neutral current $I_N = I_a + I_b + I_c$

$$= (I_{a_0} + I_{a_1} + I_{a_2}) + (I_{b_0} + I_{b_1} + I_{b_2}) + (I_{c_0} + I_{c_1} + I_{c_2})$$

$$= 3I_{a_0} + (1 + \alpha^2 + \alpha)I_{a_1} + (1 + \alpha^2 + \alpha)I_{a_2}$$

We know that $(1 + \alpha^2 + \alpha) = 0$

So, $I_N = 3I_{a_0}$

$I_N = 3 \times 0 + 0 + 0 = 0A$

Note: always neutral current is 3 times of zero sequence current.

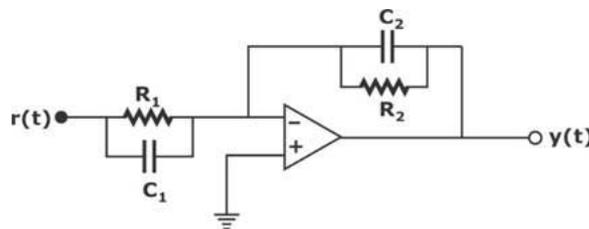
5. In three phase cycloconverters, the reduction factor is given by

- A. $\left(\frac{\text{Input frequency}}{\text{Output frequency}} \right)$
- B. $\sqrt{\frac{\text{Output frequency}}{\text{Input frequency}}}$
- C. $\sqrt{\frac{\text{Input frequency}}{\text{Output frequency}}}$
- D. $\frac{\text{Output frequency}}{\text{Input frequency}}$

Ans. D

Sol. Reduction factor = $\frac{\text{Output frequency}}{\text{Input frequency}}$

6. For the given op-amp circuit, find the transfer function $\frac{Y(s)}{R(s)}$. if $R_1 = R_2, C_1 = C_2$



- A. 1
- B. -2
- C. 2
- D. -1

Ans. D

Sol. This is an inverting op-amp, hence

$$\frac{y(t)}{x(t)} = \frac{-z_2}{z_1}$$

$$\frac{Y(s)}{R(s)} = \frac{-z_2(s)}{z_1(s)}$$

$$Z_2(s) = \frac{R_2}{1 + sR_2C_2}$$

$$Z_1(s) = \frac{R_1}{1 + sR_1C_1}$$

$$\frac{Y(s)}{R(s)} = \frac{-R_2}{1 + sR_2C_2} \times \frac{1 + sR_1C_1}{R_1}$$

Here, $R_1 = R_2, C_1 = C_2$

$$\frac{Y(s)}{R(s)} = -1$$

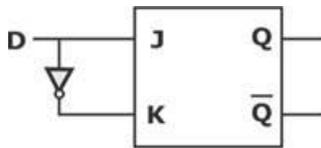
7. Swinburne's Test is related to

- A. Transformer
- B. Induction Machine
- C. Synchronous Machine
- D. DC Machine

Ans. D

Sol. Swinburne's test is the most commonly used and simplest method of testing of shunt and compound wound DC machines which have constant flux. In this test the efficiency of the machine at any load is pre-determined. We can run the machine as a motor or as a generator.

8. A flip-flop is shown below,



What could be the resultant flip-flop??

- A. JK flip flop
- B. D- flip flop
- C. SR flip flop
- D. T- flip flop

Ans. B

Sol. $J = D, K = \bar{D}$

We know $Q_{n+1} = J\bar{Q} + \bar{K}Q_n$ For JK flipflop

$$= D\bar{Q} + \bar{D}Q_n$$

$$Q_{n+1} = D$$

So, D-flip flop.

9. For a purely inductive rotor of a 3 – phase induction machine, if rotor power factor angle is 90° , then electromagnetic torque becomes

- A. 0
- B. Maximum
- C. In between minimum to maximum
- D. None of the above

Ans. A

Sol.

Inductive reactive, $X_L = \omega L$

$$\therefore X_L = 1 \times 1 = 1\Omega$$

Impedance, $Z = 1 + j1$

$$|Z| = \sqrt{1^2 + 1^2} = \sqrt{2}\Omega$$

$$\therefore I_{1\text{rms}} = \frac{V_{1\text{rms}}}{|Z_1|} = \frac{10/\sqrt{2}}{\sqrt{2}} \Rightarrow I_{1\text{rms}} = 5\text{A}$$

(2) When only $V_2 = 10\sqrt{5} \sin 2t$ is operating,

Angular frequency, $\omega = 2\text{rad/sec}$

$$X_L = \omega L = 2 \times 1 = 2\Omega$$

$$Z = 1 + j2$$

$$|Z| = \sqrt{1^2 + 2^2} = \sqrt{5}\Omega$$

$$\therefore I_{2\text{rms}} = \frac{V_{2\text{rms}}}{|Z_2|} = \frac{10\sqrt{5}}{\sqrt{5}} \Rightarrow I_{2\text{rms}} = 5\sqrt{2}\text{A}$$

(3) When only 5V(DC) is operating,

$$\omega = 0, \therefore X_L = 0$$

$$Z = 1\Omega$$

$$I_3 = \frac{V}{Z} = \frac{5}{1} = 5\text{A}$$

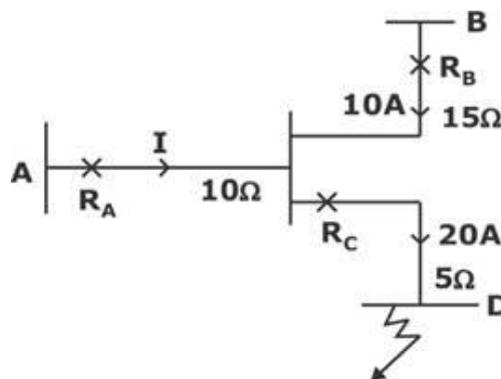
$$\therefore \text{Ammeter reading} = \sqrt{I_1^2 + I_2^2 + I_3^2} = \sqrt{5^2 + (5\sqrt{2})^2 + 5^2} = 10\text{A}$$

13. Temperature at which antiferromagnetic material converts to paramagnetic material is known as _____ temperature.
- | | |
|----------|----------------|
| A. Curie | B. Curie-Weiss |
| C. Neel | D. Debye |

Ans. C

Sol. Temperature at which antiferromagnetic material converts to paramagnetic material is known as Neel temperature.

14. What is the impedance seen by relay A (in Ω) in the below arrangement?



- A. 5Ω
- B. 20Ω
- C. 25Ω
- D. 10Ω

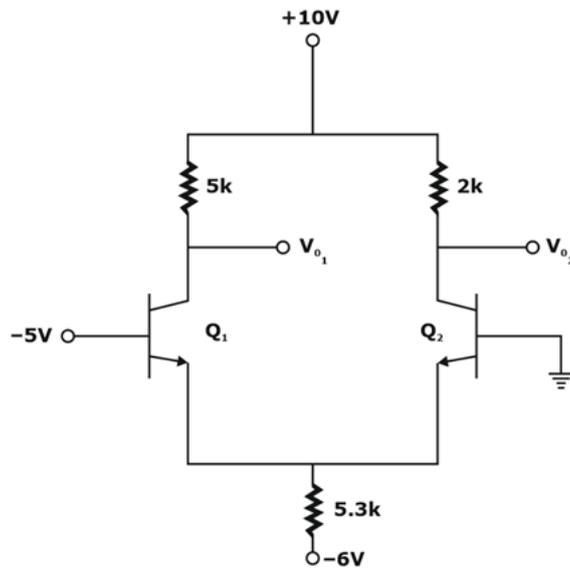
Ans. B

Sol.

$$Z_{seen,A} = \frac{V_A}{I_A} = \frac{10(10) + 20(5)}{10}$$

$$= \frac{200}{10} = 20\Omega$$

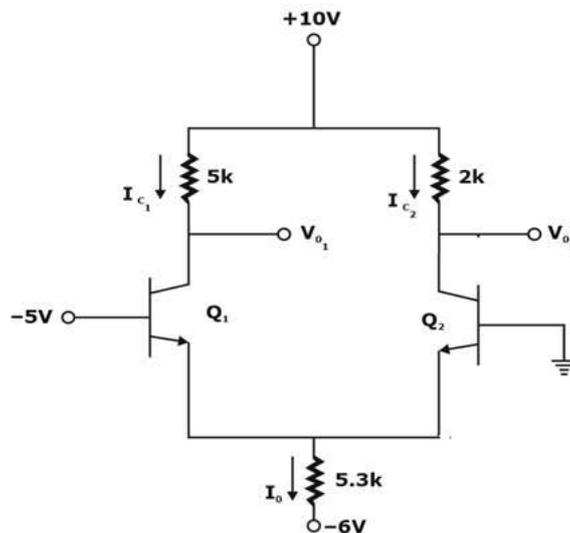
15. The differential DC output voltage $V_{o1} - V_{o2}$ in the circuit shown is ____ V



- A. 5V
- B. 10V
- C. 8V
- D. 2V

Ans. D

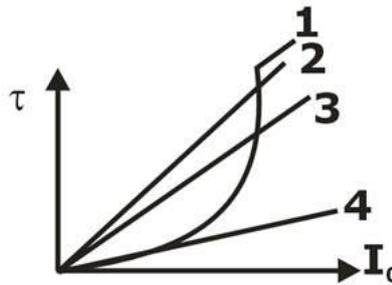
Sol.



⇒ the base of Q_1 is biased with negative voltage hence $Q_1 \rightarrow$ OFF

$$\begin{aligned}
 Q_2 &\rightarrow \text{ON} \\
 \Rightarrow I_{C_1} &= 0 \\
 \Rightarrow V_{O_1} &= 10\text{V} \\
 \Rightarrow V_{E_2} &= -0.7\text{V} \\
 \Rightarrow I_0 &= \frac{-0.7\text{V} + 6\text{V}}{5.3\text{k}} = 1\text{mA} \\
 \Rightarrow V_{O_2} &= 10 - 2 \times 1 = 8\text{V} \\
 \Rightarrow V_{O_1} - V_{O_2} &= 10 - 8 = 2\text{V}
 \end{aligned}$$

16. In the torque current characteristics shown, match the current sequence:
- (i) Series motor
 - (ii) Shunt motor
 - (iii) Cumulative compound motor
 - (iv) Differential compound motor.

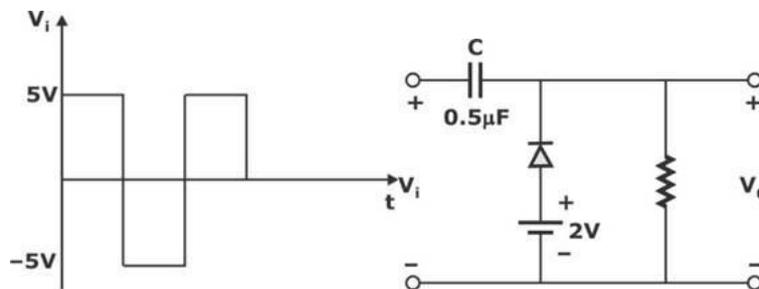


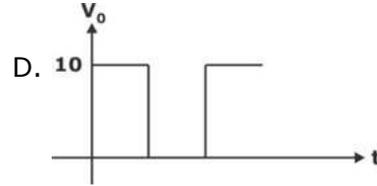
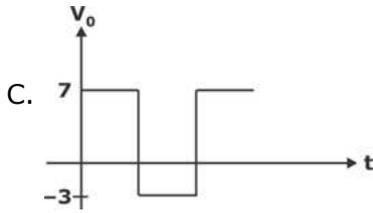
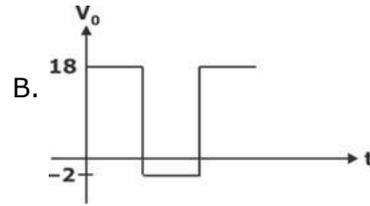
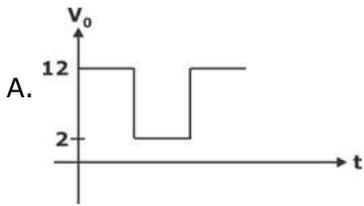
- A. 1 - (i) , 2 - (ii), 3 - (iv) , 4 - (iii)
- B. 1 - (iv) , 2 - (iii), 3 - (ii) , 4 - (i)
- C. 1 - (i) , 2 - (iii), 3 - (ii) , 4 - (iv)
- D. 1 - (i) , 2 - (ii), 3 - (iii) , 4 - (iv)

Ans. C

Sol. Same as above

17. Select the correct output (V_o) wave shape for a given input (V_i) in the damping network given below.





Ans. A

Sol. Apply KVL in negative cycle, diode on

$$V_i - 2 - V_C = 0$$

V_i maximum voltage

$$V_C = V_i - 2$$

$$V_C = -5 - 2 = -7V$$

Now,

$$V_o = V_i - V_C$$

For $V_i = +5V$ (positive cycle)

$$V_o = 5 - (-7) = 12V$$

For $V_i = -5V$ (negative cycle)

$$V_o = -5 - (-7) = 2V$$

18. Consider two meters A and B. Meter A has a range of (0 – 150) V and multiplier resistance of 50 kΩ. Meter B has a range of (0 – 500) V and a multiplier resistance of 180 kΩ. Meter A and B have basic meter resistances of 1 kΩ and 2 kΩ respectively. Determine which meter is more sensitive?

A. A is more sensitive than B

B. B is more sensitive than A

C. Both meters have same sensitivity

D. None of these

Ans. B

Sol. Sensitivity, $S = \frac{R + R_m}{V}$

For Meter A,

$$R = 50 \text{ k}\Omega$$

$$R_m = 1 \text{ k}\Omega$$

$$V = 150 \text{ V}$$

$$\Rightarrow S_A = \frac{50 \text{ k}\Omega + 1 \text{ k}\Omega}{150}$$

$$S_A = 340 \text{ }\Omega/V$$

For Meter B,

$$R = 180 \text{ k}\Omega$$

$$\nabla \times \vec{H} = J$$

$$B = \mu H$$

$$\Rightarrow \nabla \times \vec{B} = \frac{J}{\mu}$$

$\therefore \nabla \times \vec{B} \neq 0 \Rightarrow$ Magnetic field is rotational.

23. In a DC machine, armature MMF is
- A. Stationary in space
 - B. Having triangular space distribution
 - C. Both (a) and (b)
 - D. Neither (a) Nor (b)

Ans. C

Sol. In a DC machine, armature MMF is stationary in space and has triangular space distribution.

24. In SCR, if the reverse voltage is increased above critical breakdown level then, avalanche occurs at junction.
- A. J1 only
 - B. J2 and J3
 - C. J1 and J3
 - D. J3 only

Ans. C

Sol. In SCR, if the reverse voltage is increased above critical breakdown level then, avalanche occurs at junction at J1 and J3.

25. An energy meter rated as 5 A, 230 V makes 480 revolutions per kWh. In a test at full load, unity power factor, it makes 6 revolutions in 64 seconds, then which of the following statement is correct?
- A. The meter runs slower and error is 38.8%
 - B. The meter runs faster and error is 22.5%
 - C. The meter runs slower and error is 225.5%
 - D. The meter runs faster and error is 38.8%

Ans. A

Sol. Energy consumed in 64 second,

$$E = 230 \times 5 \times 64 \text{ watt-sec}$$

$$= \frac{230 \times 5 \times 64}{3600 \times 1000}$$

$$= 0.0204 \text{ kWh}$$

Meter constant, $k = 480 \text{ rev/kWh}$

So, Number of revolutions = $480 \times 0.0204 = 9.813 \text{ rev.}$

This means, it should make 9.813 revolutions.

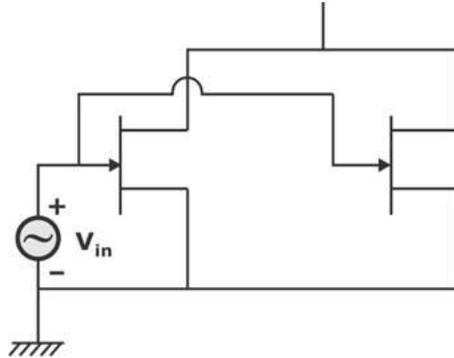
But it makes 6 revolutions.

$$\% \text{ Error} = \frac{N_2 - N_1}{N_1} \times 100$$

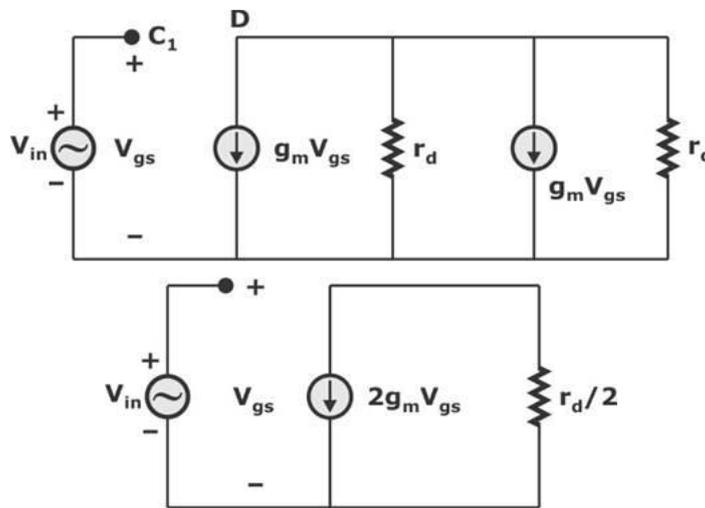
34. If two identical JFETs are connected in parallels, then Drain resistance (resultant) will be
- A. Double of single JFET
 - B. Half of single JFET
 - C. Exactly equal to single JFET
 - D. cannot be determined

Ans. B

Sol.



Small signal model of JFET



So $r_d' = r_d/2$

35. Hand tool application uses which of the following motors?
- A. AC series motor
 - B. Shaded pole motor
 - C. Resistance motor
 - D. None of the above

Ans. A

Sol. For hand tool applications, AC series motor is used.

So, Option (A) is correct.

36. Statement (I): In thyristor, local hot spots will be formed near the gate connection on accounts of high current density.

Statement (II): Rate of rise of anode current is large as compared to the spread velocity of carriers.

- A. Both statement (I) and statement (II) are true and statement (II) is correct explanation of statement (I)
- B. Both statement (I) and statement (II) are true but statement (II) is not a correct explanation of statement (I)

$$\omega t_0 = \frac{\pi}{4}$$

$$\omega = 8 \text{ rad/s}$$

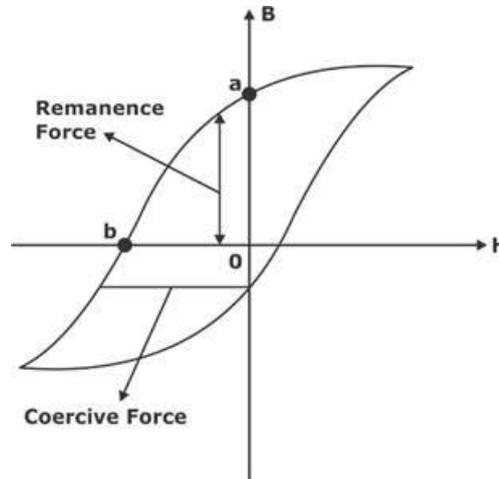
$$\therefore 8t_0 = \frac{\pi}{4}$$

$$\Rightarrow t_0 = \frac{\pi}{32} \text{ s}$$

39. Which of the following magnetic materials have high remanence and large coercivity?
- | | |
|---------------------------|---------------------------|
| A. Diamagnetic material | B. Hard magnetic material |
| C. Soft magnetic material | D. None of the above |

Ans. B

Sol. Hard magnetic material has large hysteresis loop area, So, hysteresis loss is also more, remanence is high and coercivity is large.



40. Which of the pole zero plot corresponds to an even function



Ans. C

Sol. For a signal to be even, it must be either two sided or finite duration, therefore $x(s)$ has poles, the ROC must be strip in the s-plane

For (a), $x(s) = \frac{As}{(s+1)(s-1)}$

So $x(-s) = \frac{-As}{(s+1)(s-1)} = -x(s)$

So $x(t)$ is not even

For (b), ROC can not be chosen to corresponding to a two sided function $x(t) \Rightarrow$ Not even

for (c), We have $x(s) = \frac{A(s - j)(s + j)}{(s + 1)(s - 1)}$

$$= \frac{A(s^2 + 1)}{(s^2 - 1)}$$

So $x(-s) = \frac{A(s^2 + 1)}{s^2 - 1} = x(s)$

So even

for (d) ,ROC cannot be chosen to corresponding to a two sided function $x(t) \Rightarrow$ So not even

41. The open loop transfer function of unity feedback control system is given by $G(s) = \frac{k}{s(s^2 + 8s + T)}$, where $k, T > 0$. Using Routh's criterion, determine the value of k for which

system will be stable?

A. $k > 8T$

B. $k < 8T$

C. $k > 0$

D. $0 < k < 8T$

Ans. D

Sol. Characteristic Equation:

$$1 + G(s) H(s) = 0$$

$$1 + \frac{k}{s(s^2 + 8s + T)} = 0$$

$$s^3 + 8s^2 + sT + k = 0$$

Routh's array is shown below,

s^3	1	T
s^2	8	k
s	$\frac{8T - k}{8}$	0
s^0	k	

For system to be stable there should be no sign change in the first column of the Routh's array.

$$\therefore \frac{8T - k}{8} > 0 \text{ and } k > 0$$

$$8T - k > 0$$

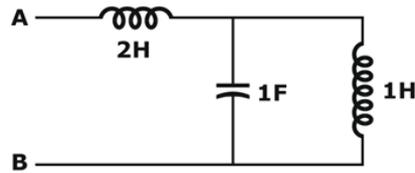
$$k - 8t < 0$$

$$k < 8T$$

$$k > 0$$

$$\Rightarrow 0 < k < 8T$$

42. Resonance frequency of the circuit shown below is



A. 3 rad/sec

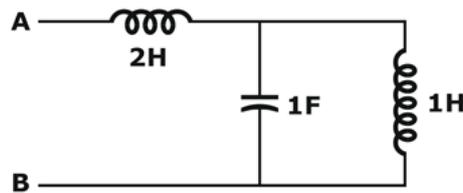
B. 5 rad/sec

C. $\sqrt{\frac{3}{2}}$ rad/sec

D. $\sqrt{\frac{2}{3}}$ rad/sec

Ans. C

Sol.



Impedance at frequency ω rad/ sec

$$z = 2j\omega + \frac{(j\omega \times 1) \times \frac{1}{j\omega \times 1}}{j\omega + \frac{1}{j\omega \times 1}}$$

$$z = 2j\omega + \frac{j\omega}{1 - \omega^2}$$

$$z = j \left(2\omega + \frac{\omega}{1 - \omega^2} \right)$$

$$z = j \left(2\omega + \frac{\omega}{1 - \omega^2} \right)$$

For calculation of resonance frequency imaginary part of $z = 0$

$$\left(2\omega + \frac{\omega}{1 - \omega^2} \right) = 0$$

$\omega = 0$ (not possible)

and

$$2 + \frac{1}{1 - \omega^2} = 0$$

$$2 - 2\omega^2 + 1 = 0$$

$$2\omega^2 = 3$$

$$\omega^2 = \frac{3}{2}$$

$$\Rightarrow \omega = \sqrt{\frac{3}{2}} \text{ rad/sec}$$

Ans. D

Sol. Corona loss is given by Peek's formula.

$$P_c = \frac{244}{\delta} (f + 25) (V_{ph} - V_d)^2 \sqrt{\frac{r}{D}} \times 10^{-5} \text{ kW / km / phase}$$

Where, P_c = corona power loss

f = frequency

V_{ph} = phase voltage

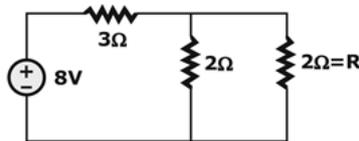
V_d = Disruptive voltage

r → Radius of conductor

D → distance between conductors

It also affected by atmosphere, surface irregularity, rough surface, operating voltage, and Air Density factor.

46. If R changed to 3Ω then what is change in current flowing through R .



A. 0.478

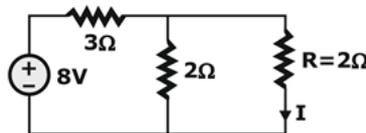
B. 0.238

C. 0.516

D. 0.258

Ans. B

Sol.



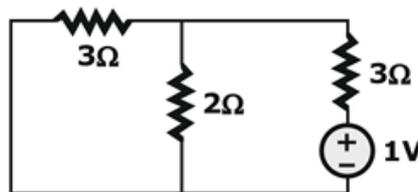
$$I = \frac{1}{2} \times \frac{8}{3 + (2 \parallel 2)} = 1A$$

Now according to compensation theorem

$$V_s = \Delta Z \cdot I$$

$$= (3 - 2) \times 1$$

Short circuit voltage source.



$$R_{eq} = 3 + (3 \parallel 2)$$

$$= 4.2 \text{ V}$$

$$I = \frac{1}{4.2}$$

$$= 0.238 \text{ A}$$

50. The electric flux density is _____ to the electric flux lines and the electric fields is _____ to the electrical potential lines.

- A. normal; tangential
- B. tangential; normal
- C. tangential; tangential
- D. normal; normal

Ans. B

Sol. The electric flux density is tangential to the electric flux and the electric fields is normal to the electrical potential lines.

51. The average of 31 numbers is 59. The average of the first 11 numbers is 53.9 and that of the last 21 numbers is 62.1. If the 11th number is excluded, then what is the average of the remaining numbers?

- A. 58.7
- B. 59.2
- C. 57.9
- D. 57.4

Ans. A

Sol. Given:

Average of 31 numbers = 59.

The average of the first 11 numbers = 53.9 and

That of the last 21 numbers = 62.1

Eleventh number = Sum of first 11 numbers + sum of last 21 numbers – Sum of 31 numbers

$$= 11 \times 53.9 + 21 \times 62.1 - 31 \times 59$$

$$= 592.9 + 1304.1 - 1829$$

$$= 1897 - 1829 = 68$$

Now, sum of remaining numbers (excluding 11th number) = $31 \times 59 - 68$

$$= 1829 - 68 = 1761$$

Average of remaining numbers = $1761/30 = 58.7$

Hence, the correct answer is option A.

52. The greatest 5-digit number, which leaves 11 as remainder when divided by 12, 20, 28 & 39 is

- A. 98921
- B. 98931
- C. 99981
- D. 98291

Ans. D

Sol. $12 = 2^2 \times 3,$

$$20 = 2^2 \times 5,$$

$$28 = 2^2 \times 7 \text{ and}$$

$$39 = 3 \times 13$$

$$\text{LCM of } 12, 20, 28 \text{ \& } 39 = 2^2 \times 3 \times 5 \times 7 \times 13 = 5460$$

Therefore, the required number will be of the form $5460k + 11$, where $k = 1, 2, 3, 4...$

Now greatest 5-digit number is 99999 but it is not in the form of $5460k + 11$.

$99999/5460$ leaves remainder 1719.

Hence, the required number is $99999 - 1719 + 11 = 98291$

$$\Rightarrow \log_x ac = 2\log_x b = \log_x b^2$$

Taking antilog on both sides,

$$b^2 = ac \text{ i.e. } a, b \text{ and } c \text{ are in GP}$$

hence, (B) is the correct answer

56. If $13A = 11B = 8C$, find $A : B : C$

A. 143:104:88

B. 104:88:143

C. 88:104:143

D. 8:11:13

Ans. C

Sol. Given: $13A = 11B = 8C$

$$\frac{A}{B} = \frac{11}{13} = \frac{\frac{11}{13}}{1}$$

$$\text{And } \frac{B}{C} = \frac{8}{11} = \frac{1}{\frac{11}{8}}$$

$$\begin{aligned} \text{So, } A : B : C &= 11/13 : 1 : 11/8 \\ &= 11 \times 8 : 13 \times 8 : 11 \times 13 \\ &= 88 : 104 : 143 \end{aligned}$$

57. U, V and W invest sum in the ratio of 15 : 20 : 27 respectively. If they earned total profit of ₹ 10230 at the end of year, then what is the share of V?

A. ₹2870

B. ₹3300

C. ₹3150

D. ₹3500

Ans. B

Sol. U, V and W invest sum in the ratio of 15 : 20 : 27 respectively.

We know, Profit = Amount × Time

Here time for U, V and W is same.

So, the ratio of profit is same as that of Amount Invested.

Let profit earned by U = 15k

Profit earned by V = 20k

Profit earned by W = 27k

According to the question,

$$\Rightarrow 15k + 20k + 27k = ₹ 10230$$

$$\Rightarrow 62k = ₹ 10230$$

$$\Rightarrow k = ₹ 165$$

$$\text{Hence, Share of V} = 20 \times ₹ 165 = ₹3300$$

58. Reena took a loan of Rs. 1200 with simple interest for as many years as the rate of interest. If she paid Rs. 432 as interest at the end of the loan, what was the rate of interest?

A. 3.6

B. 6

C. 18

D. 20

Ans. B

Sol. Principal = Rs. 1200

Let Reena took this loan of Rs. 1200 with simple interest for x years.

According to the question,

Rate of interest = x% p.a.

Simple interest = Rs. 432

$$\text{Hence, Simple Interest} = \frac{P \times R \times T}{100}$$

$$432 = \frac{1200 \times x \times x}{100}$$

$$\Rightarrow x^2 = \frac{43200}{1200} = 36$$

$$\Rightarrow x = 6$$

Hence, Rate of interest = 6% p.a.

59. A bought a computer system for ₹ 40,000 and sold it to B at a loss of 4%. If B sold it to C for ₹ 40,320, profit percent for B is

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

Ans. B

Sol. Cost price of computer for A = ₹ 40000

A sold it to B at a loss of 4 % i.e. at 96% of its cost price.

$$\Rightarrow \text{C.P. for B} = 40000 \times \frac{96}{100} = ₹ 38400$$

B sold this computer to C for ₹ 40320

$$\Rightarrow \text{Gain to B} = 40320 - 38400 = ₹ 1920$$

$$\Rightarrow \text{Gain percent} = \frac{1920 \times 100}{38400} = 5\%$$

60. The volume of a cone is equal to that of a cylinder whose height is 9 cm and diameter 60 cm. Find the radius of the base of cone if its height is 108 cm.

- A. 12 cm
- B. 18 cm
- C. 10 cm
- D. 15 cm

Ans. D

Sol. Volume of cone = volume of cylinder

$$\frac{1}{3} \pi r^2 h = \pi \times (30)^2 \times 9$$

$$r^2 = \frac{3 \times 30 \times 30 \times 9}{108}$$

$$r^2 = \frac{900}{4}$$

$$r = \frac{30}{2} = 15 \text{ cm}$$

\therefore In 30 sec B runs = $\frac{1000}{300} \times 30 = 100$ meter

Hence, A can give a start of 100 m to B.

72. If $x + \frac{1}{y} = y + \frac{1}{z} = z + \frac{1}{x}$, where $x \neq y \neq z$, then what is the value of xyz ?

- A. 1
- B. -1
- C. Both A & B
- D. None of these

Ans. C

Sol.

Given that, $x + \frac{1}{y} = y + \frac{1}{z} = z + \frac{1}{x}$

$\Rightarrow x - y = \frac{1}{z} - \frac{1}{y}, y - z = \frac{1}{x} - \frac{1}{z}, x - z = \frac{1}{x} - \frac{1}{y}$

$\Rightarrow x - y = \frac{y - z}{yz}, y - z = \frac{z - x}{xz}, x - z = \frac{y - x}{xy}$

Multiplying all the above three equations:

$\Rightarrow (x - y)(y - z)(x - z) = \frac{(y - z)(z - x)(y - x)}{yz \cdot xz \cdot xy}$

$\Rightarrow (x - y)(y - z)(x - z) = \frac{(y - z)(x - z)(x - y)}{yz \cdot xz \cdot xy}$

$\Rightarrow 1 = \frac{1}{x^2y^2z^2}$

$\Rightarrow x^2y^2z^2 = 1$

$\Rightarrow xyz = \pm 1$

73. If $x^4 + x^2y^2 + y^4 = 21$ and $x^2 + xy + y^2 = 3$, then what is the value of $(-xy)$?

- A. 2
- B. 1
- C. -1
- D. -2

Ans. A

Sol.

$x^4 + x^2y^2 + y^4 = 21$

$x^2 + xy + y^2 = 3$(1)

As we know, $(x^4 + x^2y^2 + y^4) = (x^2 + xy + y^2)(x^2 - xy + y^2)$

$\Rightarrow 21 = (3)(x^2 - xy + y^2)$

$\Rightarrow (x^2 - xy + y^2) = \frac{21}{3} = 7$(2)

Subtract (2) from (1)

$$\Rightarrow 2xy = -4$$

$$\Rightarrow xy = -\frac{4}{2} = -2$$

$$\Rightarrow -xy = 2$$

74. Which of the following quadratic equations will not have real roots?

A. $5x^2 + 7x + 1 = 0$

B. $6x^2 - 3x - 1 = 0$

C. $7x^2 - 6x + 1 = 0$

D. $3x^2 + 4x + 2 = 0$

Ans. D

Sol. We know that for a quadratic equation $ax^2 + bx + c = 0$, roots are real only if $b^2 - 4ac \geq 0$.

Therefore,

Option A: $5x^2 + 7x + 1 = 0$

$$b^2 - 4ac = 7^2 - 4 \times (5) \times (1)$$

$$= 49 - 20 = 29 > 0$$

Hence, it will have real roots.

Option B: $6x^2 - 3x - 1 = 0$

$$b^2 - 4ac = 3^2 - 4 \times (6) \times (-1)$$

$$= 9 + 24 = 33 > 0$$

Hence, it will have real roots.

Option C: $7x^2 - 6x + 1 = 0$

$$b^2 - 4ac = 6^2 - 4 \times (7) \times (1)$$

$$= 36 - 28 = 8 > 0$$

Hence, it will have real roots.

Option D: $3x^2 + 4x + 2 = 0$

$$b^2 - 4ac = 4^2 - 4 \times (3) \times (2)$$

$$= 16 - 24 = -8 < 0$$

Hence, it will not have real roots.

Therefore, option D is the answer.

75. What is the square root of $\frac{(0.35)^2 + 0.70 + 1}{2.25} + 0.19$?

A. 1

B. 2

C. 3

D. 4

Ans. A

Sol.

$$\frac{(0.35)^2 + 0.70 + 1}{2.25} + 0.19$$

$$= \frac{0.1225 + 0.70 + 1}{2.25} + 0.19$$

$$= \frac{1.8225}{2.25} + 0.19$$

$$= 0.81 + 0.19 = 1$$

Hence option (a)

76. $\log(x + 4) + \log(x - 4) = 2\log 3$, find the value of x

A. 5

B. 4

C. 3

D. none of these

Ans. A

Sol. *Tip* - $\log a + \log b = \log ab$ & $\log a^n = n \log a$

$$\log(x + 4) + \log(x - 4) = 2\log 3$$

$$\Rightarrow \log(x + 4)(x - 4) = \log 3^2$$

Taking antilog on both sides,

$$x^2 - 16 = 9$$

$$\Rightarrow x^2 = 25$$

$$\Rightarrow x = 5 \text{ [as log of a negative value is not plausible]}$$

Hence, (A) is the correct answer

77. The students in three classes are in the ratio 4:6:9. If 12 students are increased in each class, the ratio changes to 7:9:12. Then the total number of students in the three classes before the increase is.

A. 100

B. 114

C. 95

D. 76

Ans. D

Sol. Ratio before increase in number = 4:6:9

Ratio after increase in number = 7:9:12

Increased ratio = 3; Increase in number of students = 3x

$$\Rightarrow 3x = 12 \Rightarrow x = 4$$

\therefore number of students in three classes before the increase = $4x + 6x + 9x$

$$= 4 \cdot 4 + 4 \cdot 6 + 4 \cdot 9 = 16 + 24 + 36 = 76$$

78. A started a business with a capital of Rs.5000 and another person B joins the business after some months with a capital of Rs.4000, out of the total annual profit of Rs.2500 A's share was Rs.1500. When B did joined the partnership?

A. After 3 months

B. After 5 months

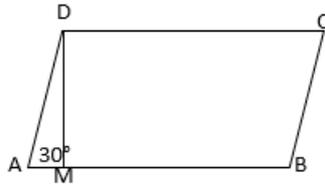
C. After 4 months

D. After 2 months

Ans. D

Sol. According to the questions

A : B



As the adjacent sides of the parallelogram are equal, it is a rhombus.

Area of a rhombus = $a^2 \sin \theta$

Hence, Area = $(20)^2 \sin 30^\circ = 400/2 = 200 \text{ cm}^2$

(Note: Rhombus is also a parallelogram)

82. Average age of husband and wife at the time of their marriage was 28 years. Two year after their marriage a baby was born. Now their present average age including child is 24 years. How many year ago they got married?

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

Ans. D

Sol. Sum of the ages of husband and wife at the time of marriage = $28 \times 2 = 56$

Let they got married x year before. Then, the baby was born $(x-2)$ year before.

so, Increase in age =

$$x + x + x - 2 = 72 - 56$$

$$3x = 72 - 56 + 2$$

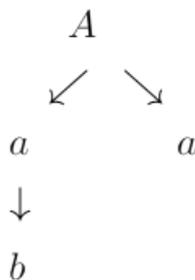
$$x = 18/3 = 6 \text{ years}$$

83. The compound interest on a certain sum of money at a certain rate per annum for two years is ₹ 2,050, and the simple interest on the same amount of money at the same rate for 3 years is ₹ 3, 000. Then the sum of money is

- A. ₹ 20,000
- B. ₹ 18,000
- C. ₹ 21,000
- D. ₹ 25, 000

Ans. A

Sol. Short Trick:-



Here,

$$3a = 3000$$

$$a = 1000 \text{ and } b = 50$$

According to ques,

$$\frac{b}{a} = \frac{a}{A}$$

$$\frac{50}{1000} = \frac{1000}{A}$$

$$A = 20,000$$

Basic method:-

We have simple interest= $(P \times T \times r) / 100$ (1)

Compound interest = $P - \left[P \left(1 + \frac{r}{100} \right)^T \right]$ (2)

Where P = principal amount

T= time

r= rate of interest

From the given data

$$2050 = P - \left[P \left(1 + \frac{r}{100} \right)^2 \right] \dots\dots\dots(3)$$

$$3000 = 3Pr / 100$$

$$\Rightarrow Pr = 100000$$

$$\Rightarrow r = 100000/P \dots\dots\dots(4)$$

By (3) and (4)

$$2050 = P - \left[P \left(1 + \frac{100000/P}{100} \right)^2 \right]$$

$$2050 = P - \left[P \left(1 + \frac{1000}{P} \right)^2 \right]$$

$$2050 = P - \left[P \left(1 + \frac{1000000}{P^2} + \frac{2000}{P} \right) \right]$$

$$2050 = P - \left[\left(P + \frac{1000000}{P} + 2000 \right) \right]$$

$$2050 = \frac{1000000}{P} + 2000$$

$$50P = 1000000$$

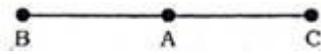
$$P = 20000$$

84. A swimmer swims from a point A against a current for 5 minutes and then swims backwards in favour of the current for next 5 minutes and comes to the point B. If AB = 100 meters, the speed of the current (in km per hour) is :

- A. 0.4
- B. 0.2
- C. 1
- D. 0.6

Ans. D

Sol.



The distance covered upstream = AC = d

$$AB = 100$$

$$BC = 100 + d$$

Rate upstream

$$= (x - y) \text{ m/minute}$$

Rate downstream

$$= (x + y) \text{ m/minute}$$

$$\therefore \frac{d}{x - y} = 5$$

$$\Rightarrow d = 5(x - y) \dots (i)$$

Again,

$$\frac{100 + d}{x + y} = 5$$

$$\Rightarrow \frac{100 + 5(x - y)}{x + y} = 5$$

$$\Rightarrow 100 + 5x - 5y = 5x + 5y$$

$$\Rightarrow 10y = 100$$

$$\Rightarrow y = 10 \text{ m/minute}$$

$$= \frac{10}{1000} \times 60 \text{ kpmh}$$

$$= 0.6 \text{ kmph}$$

85. If 5 men or 8 women can do a piece of work in 12 days, how many days will be taken by 2 men and 4 women to do the same work?

A. 15 days

B. $13\frac{1}{3}$ days

C. $13\frac{1}{2}$ days

D. 10 days

Ans. B

Sol. According to the question

$$5 \text{ men} = 8 \text{ women}$$

$$\therefore 2 \text{ men} = \frac{8}{5} \times 2 = \frac{16}{5} \text{ women}$$

$$\therefore \text{Total women} = \frac{16}{5} + 4 = \frac{36}{5} \text{ women}$$

By what percent is the number of students studying Computer Science in institutes A and B more than the number of students studying Arts in institutes B and C?

- A. 2
- B. 24
- C. 14
- D. 5

Ans. D

Sol. Number of students studying Computer Science in institutes A and B = 57+48= 105

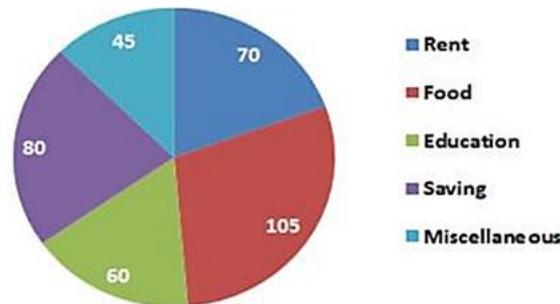
Number of students studying Arts in institutes B and C = 45+45 = 100

Difference = 105 - 100 = 5

$$\text{Required percentage} = \frac{5}{100} \times 100 = 5\%$$

89. The given Pie-Chart shows the degree wise breakup of expenditure of a family in a month. Total income of a family is Rs. 43200.

Degree of amount incurred in different expenditure (Total Rs. 43,200)



The amount spent on food is what percent of the savings and miscellaneous expense?

- A. 90%
- B. 75%
- C. 84%
- D. 60%

Ans. C

Sol. Angle of amount spent on food = 105°

Total of angles of savings and miscellaneous expense = 80° + 45° = 125°

$$\text{Required percentage} = \frac{105}{125} \times 100 = 84\%$$

Hence, the correct answer is option C.

90. Table shows the number of trees planted in 4 cities from 2016 to 2020.

Years	Chandigarh	Ahmadabad	Pune	Kolkata
2016	1800	2500	1800	2000
2017	2500	2300	1850	1800
2018	2300	2400	1840	1760
2019	2440	1950	1900	1600
2020	2250	2100	2000	1750

In which year were the maximum number of trees planted?

- A. 2018
- B. 2017
- C. 2020
- D. 2016

Ans. B

Sol. Number of trees planted in 2016 = $1800 + 2500 + 1800 + 2000 = 8100$

Number of trees planted in 2017 = $2500 + 2300 + 1850 + 1800 = 8450$

Number of trees planted in 2018 = $2300 + 2400 + 1840 + 1760 = 8300$

Number of trees planted in 2019 = $2440 + 1950 + 1900 + 1600 = 7890$

Number of trees planted in 2020 = $2250 + 2100 + 2000 + 1750 = 8100$

Hence, Maximum number of trees is planted in 2017.

91. In the following question, select the related letters from the given alternatives.

JRM : DLG :: TNL : ?

A. NHF

B. NHE

C. MHF

D. MHE

Ans. A

Sol. As,

$$J-D=10-4=6$$

$$R-L=18-12=6$$

$$M-G=13-7=6$$

Similarly,

$$T-N=20-14=6$$

$$N-H=14-8=6$$

$$L-F=12-6=6$$

Hence, option A is the correct answer.

92. Four number-pairs have been given, out of which three are alike in some manner and one is different. Select the number-pair that is different.

A. 82 : 236

B. 68 : 196

C. 54 : 152

D. 36 : 98

Ans. B

Sol. except B, all follow the logic given below:

(first number)*3-10= second number

Hence, option B is the correct answer.

93. Select the letter-cluster from among the given options that can replace the question mark(?) in the following series.

MEND, PHJZ, SKFV, VNBR, ?

A. YQXN

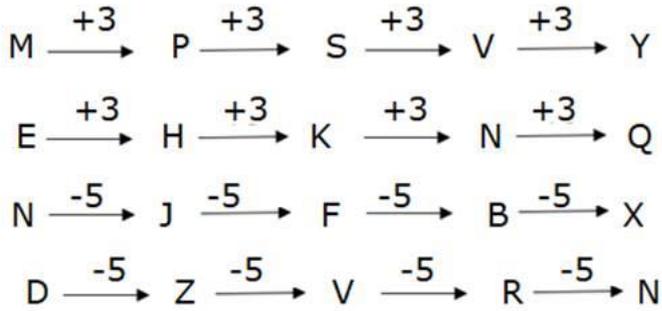
B. YJYN

C. YQZM

D. YRXO

Ans. A

Sol. Pattern is:



Hence, option A is the correct answer.

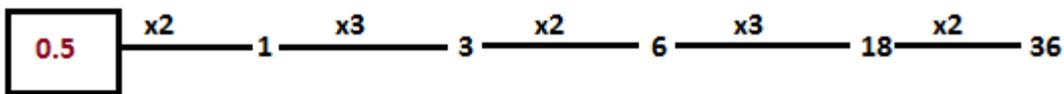
94. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.

?, 1, 3, 6, 18, 36

- A. 1
- B. 0.5
- C. 0.25
- D. 0.75

Ans. B

Sol. The series will be,



Hence, option B is correct.

95. If $17 \times 37 = 27$, $53 \times 31 = 42$, then $71 \times 23 = ?$

- A. 34
- B. 47
- C. 42
- D. 36

Ans. B

Sol. As,

$$17 \times 37 = 27$$

$$17 + 37 = 54$$

$$54/2=27$$

$$53 \times 31 = 42$$

$$53 + 31 = 84$$

$$84/2=42$$

$$71 \times 23=?$$

$$71 + 23=94$$

$$94/2=47$$

Hence, option B is the right answer.

96. In a particular code system 'YOUR' is written as ' ?x&# ' and 'SKIN' is written as ' @<€€' .How is ' SONU ' written in that code system ?

- A. @&\$?
- B. @x€&
- C. €x?<
- D. <€?#

Ans. B

Sol. As, YOUR is coded as,
 Y O U R
 ? × & #
 and SKIN is coded as
 S K I N
 @ < ₹ €

From the above codes SONU will be coded as,

S-> @

O-> ×

N->€

U->&

So, ' SONU ' is written as @ ×€&

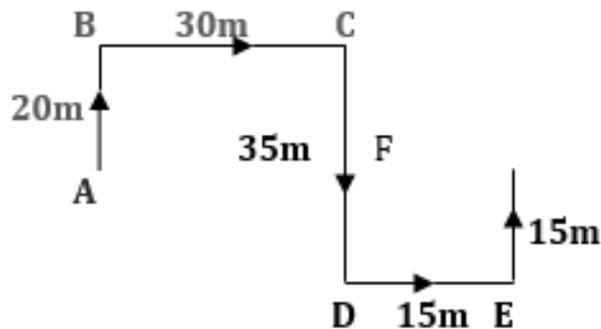
Hence, option B is the correct response.

97. Payal walked 20 m towards north. Then she turned right and walks 30 m. Then she turns right and walks 35 m. Then she turns left and walks 15 m. Finally she turns left and walks 15 m. In which direction and how many metres is she from the starting position?

- A. 15m West
- B. 30m East
- C. 30m West
- D. 45m East

Ans. D

Sol.



Required Distance = AF
 = 30+15
 = 45m

From the above diagram, F is in East direction from A.

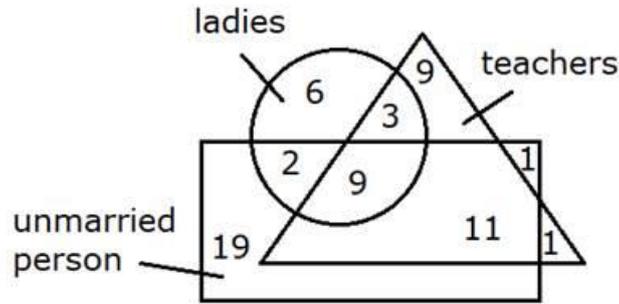
Hence the required answer is '45m East'.

98. If Rani is the wife of Ram and Rahul is the father of Sunil and Ram. What is Rahul to Rani?

- A. Brother
- B. Husband
- C. Father in law
- D. Father

Ans. C

Sol.



Number of married ladies teachers is 3.

Hence, option D is the correct answer.

101. The statements below are followed by two conclusions labeled I and II. Assuming that the information in the statements is true, even if it appears at variance with generally established facts, decide which conclusion (s logically and definitely follow(s from the information given in the statements.

Statements:

- 1) All hens are lions.
- 2) All lions are cats.

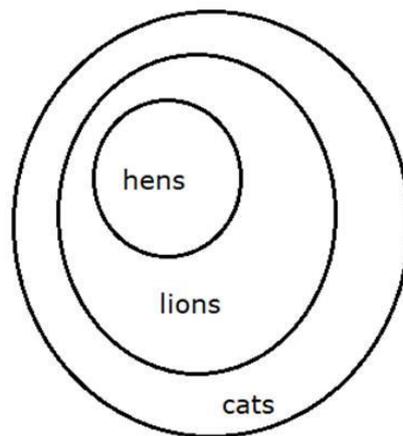
Conclusions:

- I) All cats are hens.
- II). Some cats are hens.

- A. Only conclusion I follows.
- B. Only conclusion II follows.
- C. Either conclusion I or conclusion II follows.
- D. Both conclusions follow.

Ans. B

Sol. Minimum Possible diagram is-



Conclusions:

- I) All cats are hens. (it does not follow its just a possibility, but not surety.)
- II). Some cats are hens. (it follows because All hens are lions and All lions are cats.)

So, Only conclusion II follows.

Hence, option B is the correct answer.

102. At what point of time after 3 o'clock, do the hour-hand and the minute-hand of a clock occur at right angles for the first time?

- A. 9 o'clock
- B. 4 hours $37\frac{1}{6}$ minutes
- C. 3 hours $30\frac{8}{11}$ minutes
- D. 3 hours $32\frac{8}{11}$ minutes

Ans. D

Sol. Hour-hand and minute hand make right angle when they have difference of fifteen minutes (points) between them.

After 3 o' clock

We know, The Hour hand gains $1/2^\circ$ every minute while the minute hand gains 6° every minute.

Means, the relative gain between the hour hand and minute hand = $6^\circ - 1/2^\circ = 11/2^\circ$

We also know that, the hour hand and minute hand will make right angle again when the relative gain equals 180° in the clock.

So,

$$\left(\frac{11}{2}\right)^\circ \text{ relative gain in} = 1 \text{ min}$$

$$1^\circ \text{ relative gain in} = \frac{1}{\left(\frac{11}{2}\right)^\circ} \text{ min/degree}$$

$$180^\circ \text{ relative gain in} = \frac{2}{11} \times 180^\circ$$

$$= 32\frac{8}{11} \text{ min.}$$

So they will be at right angles again at 3 hours $32\frac{8}{11}$ minutes after 3 o' clock.

103. Which year will have the same calendar as that of the year 2005?

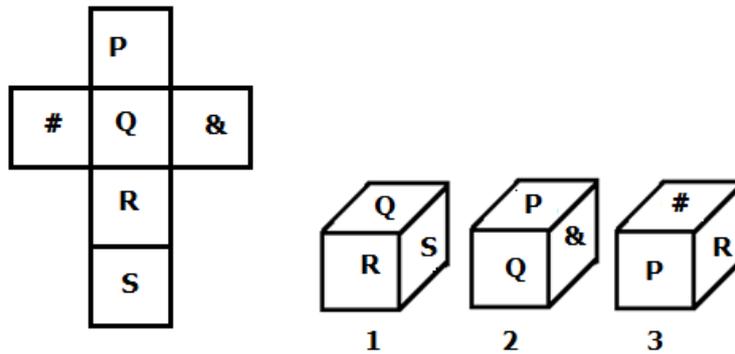
- A. 2006
- B. 2007
- C. 2008
- D. 2011

Ans. D

Sol. Odd days in years 2005 - 2010 are $1 + 1 + 1 + 2 + 1 + 1 = 7 = 0$ odd days

Hence, 2011 will be the answer.

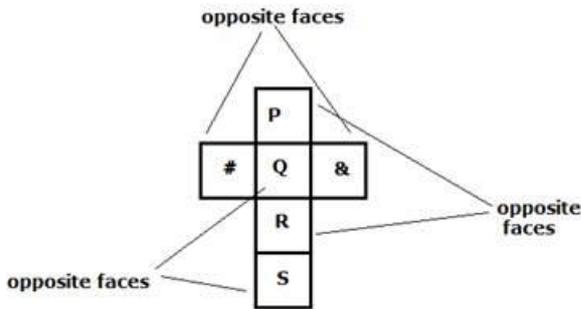
104. Select the wrong box number from given alternatives which is not similar to the box formed from the given sheet of paper X.



- A. only 1
- B. only 2
- C. only 3
- D. only 1 and 3

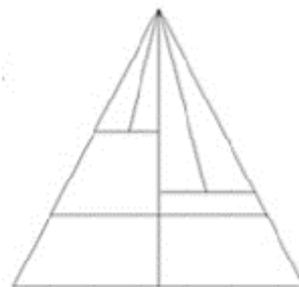
Ans. D

Sol.



Box 1 & 3 will not be formed
Hence, option D is the correct answer.

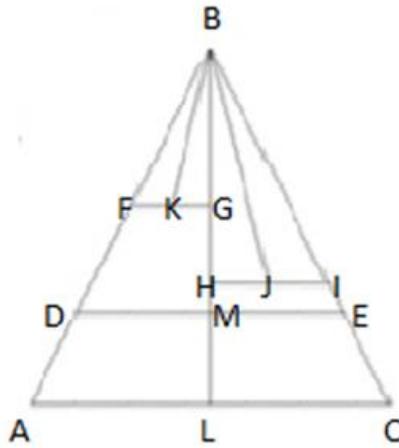
105. How many triangles are there in the given figure?



- A. 11
- B. 8
- C. 15
- D. 12

Ans. D

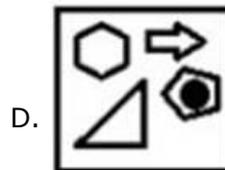
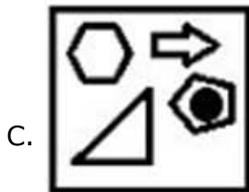
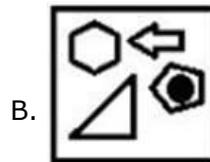
Sol.



ABC,ABL,LBC,DBM,MBI,DBE,FBG,FBK,KBG,BHI,BHJ,BJI

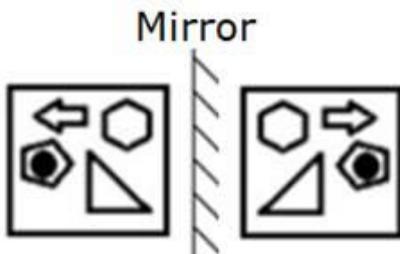
Hence, Option D is the correct answer.

106. Select the correct mirror image of the given figure when a mirror is placed on the right of the figure.



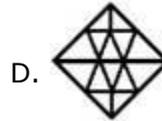
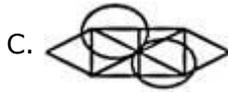
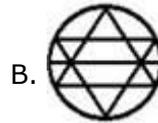
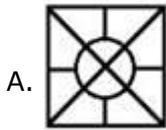
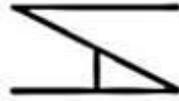
Ans. D

Sol. On close observation we find that the correct mirror image will be:



Hence, option D is the correct answer.

107. Select the figure in which the given figure is embedded.



Ans. C

Sol. On observing the options we can see that the figure given under option (C) is indeed embedded in the original figure. It has been represented below,



Hence, option C is the correct answer.

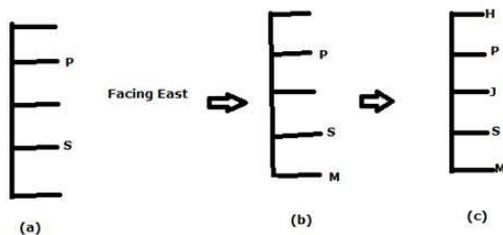
108. Five chairs J, H, P, S and M are placed in a row facing towards east (Not necessarily in the same order). P is second to the left of S. J is second to the right of H. M is to the immediate right of S.

Which of the following is the correct position of J?

- A. Third to the left of M
- B. Second to the right of H
- C. Exactly between S and H
- D. To the immediate right of S

Ans. B

Sol.



In the figure(c) shown above, it is clear that J is second to the right of H.

Hence, option B is the correct answer.

109. Priyanka is twenty years elder to Bhavna. If four years ago, Priyanka was twice as old as Bhavna, then find the present age of Priyanka.

- A. 44 years
- B. 34 years
- C. 55 years
- D. 56 years

Ans. A

Sol. Suppose age of Bhavna = z
age of Priyanka = $(z + 20)$
Priyanka's age 4 years ago = $(z + 20 - 4)$
Bhavna's age 4 years ago = $(z - 4)$
ATQ,
 $(z + 20 - 4) = 2(z - 4)$
Or, $z + 16 = 2z - 8$
Or, $2z - z = 16 + 8$
Or, $z = 24$ years
age of Priyanka = $(z + 20) = 24 + 20 = 44$ years
Hence, option A is the correct answer.

110. By interchanging which two signs, the equation will be correct?

$$22 + 23 \times 253 \div 11 = 529$$

A. + and \times

B. + and \div

C. \div and \times

D. None of the above

Ans. A

Sol. Option (A), interchange + and \times

$$22 + 23 \times 253 \div 11 = 529$$

$$\text{Becomes : } 22 \times 23 + 253 \div 11 = 529$$

Taking L.H.S,

$$22 \times 23 + \frac{253}{11}$$

$$506 + 23$$

$$529 = \text{R.H.S}$$

Hence, option A is the correct answer.
