’2010-CE-’27-39”

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1) The inverse of the matrix

$$\begin{pmatrix} 3+2i & i \\ -i & 3-2i \end{pmatrix}$$

is

a) $\frac{1}{12}\begin{pmatrix} 3+2i & -i \\ i & 3-2i \end{pmatrix}$

b) $\frac{1}{12}\begin{pmatrix} 3-2i & -i \\ i & 3+2i \end{pmatrix}$

c) $\frac{1}{14}\begin{pmatrix} 3+2i & -i \\ i & 3-2i \end{pmatrix}$

d) $\frac{1}{14}\begin{pmatrix} 3-2i & -i \\ i & 3+2i \end{pmatrix}$

2) The table below gives values of a function $F(x)$ obtained for values of x at intervals of 0.25 .

x	0	0.25	0.5	0.75	1.0
$\overrightarrow{F}(x)$	1	0.9412	0.8	0.64	0.50

The value of the integral of the function between the limits 0 to 1 using Simpson’s rule is

a) 0.7854 b) 2.3562 c) 3.1416 d) 7.5000

3) The partial differential equation that can be formed from $z = ax + by + ab$ has the form $\left(\text{with } p = \frac{\partial z}{\partial x} \text{and } q = \frac{\partial z}{\partial y}\right)$

a) $z = px + qy$

b) $z = px + pq$

c) $z = px + qy + pq$

d) $z = qy + pq$

4) A parabolic cable is held between two supports at the same level. The horizontal span between the supports is L. The sag at the mid-span is h. The equation of the parabola is $y = 4h\frac{x^2}{L^2}$, where x is the horizontal coordinate and y is the vertical coordinate with the origin at the centre of the cable. The expression for the total length of the cable is

a) $\int_0^L \sqrt{l + 64\frac{h^2x^2}{L^2}}dx$

b) $2\int_0^{L/2} \sqrt{1 + 64\frac{h^3x^2}{L^4}}dx$

c) $\int_0^{2/2} \sqrt{1 + 64\frac{h^2x^2}{L^4}}dx$

d) $2\int_0^{4/2} \sqrt{1 + 64\frac{h^2x^2}{l^4}}dx$

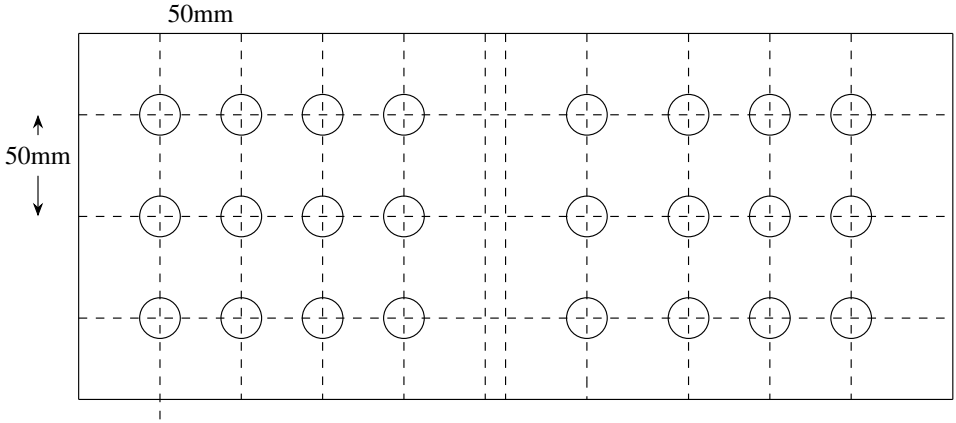
5) Given a function

$$f(x, y) = 4x^2 + 6y^2 - 8x - 4y + 8$$

The optimal value of $f(x, y)$

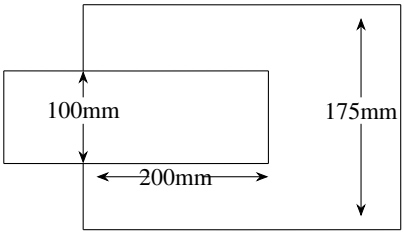
a) is a minimum equal to $10/3$
b) is a maximum equal to $10/3$
c) is a minimum equal to $8/3$
d) is a maximum equal to $8/3$

6) A double cover butt riveted joint is used to connect two flat plates of $200mm$ width and $14mm$ thickness as shown in the figure. There are twelve power driven rivets of $20mm$ diameter at a pitch of $50mm$ in both directions on either side of the plate. Two cover plates of $10mm$ thickness are used. The capacity of the joint in tension considering bearing and shear ONLY, with permissible bearing and shear stresses as $300MPa$ and $100MPa$ respectively is



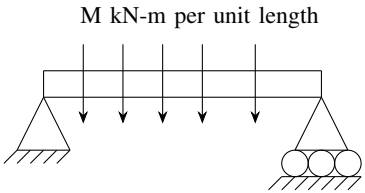
a) 1083.6 kN
b) 871.32 kN
c) 541.8 kN
d) 433.7 kN

7) Two plates, subjected to direct tension, each of $10mm$ thickness and having widths of $100mm$ and $175mm$, respectively are to be fillet welded with an overlap of $200mm$. Given that the permissible weld stress is $110MPa$ and the permissible stress in steel is $150MPa$, the length of the weld required using the maximum permissible weld size as per IS : $800 - 1984$ is



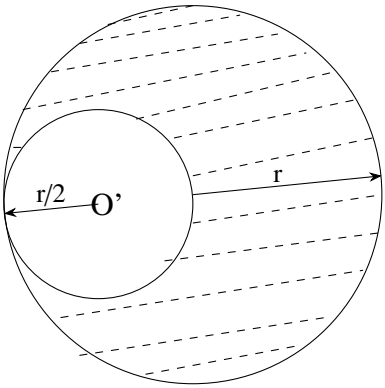
a) 245.3*mm*
b) 229.2*mm*
c) 205.5*mm*
d) 194.8*mm*

8) For the simply supported bearn of length L. subjected to a uniformly distributed moment M kN-m per unit length as shown in the figure, the bending moment (in $kN-m$) at the mid-span of the beam is



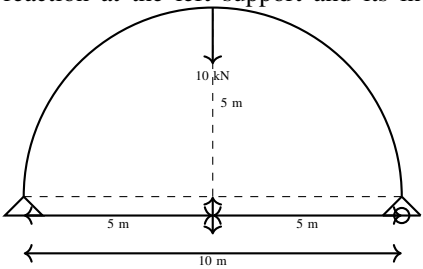
a) zero
b) M
c) ML
d) M/L

9) A disc of radius r has a hole of radius $r/2$ cut-out as shown. The centroid of the remaining disc (*shadedportion*) at a radial distance from the centre "O" is



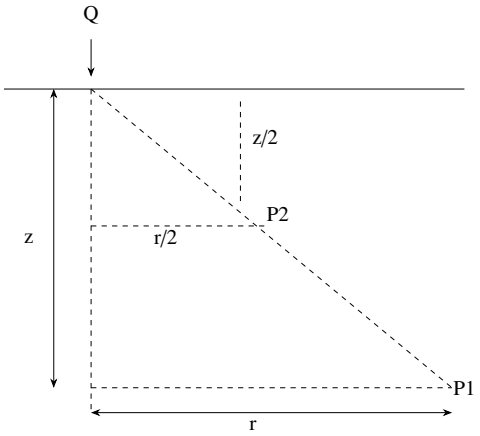
a) $\frac{r}{2}$
b) $\frac{r}{3}$
c) $\frac{r}{6}$
d) $\frac{r}{8}$

10) A three hinged paribolic arch having a span of $20m$ and a rise of $5m$ carries a point load of $10kN$ at quarter span from the left end as shown in the figure. The resultant reaction at the left support and its inclination with the horizontal are respectively



a) $9.01kN$ and $56.31°$
b) $9.01kN$ and $33.69°$
c) $7.50kN$ and $56.31°$2.50 kN and $33.69°$
d) $2.50kN$ and $33.69°$

11) The vertical stress at point P_1 due to the point load Q on the ground surface as shown in figure is σ_z. According to Boussinesq's equation, the vertical stress at point P_z shown in figure will be



a) $\sigma_z/2$
b) σ_z
c) $2\sigma_z$
d) $4\sigma_z$

12) An open ended steel barrel of $1m$ height and $1m$ diameter is filled with saturated fine sand having coefficient of permeability of $10^{-2}m/s$. The barrel stands on a saturated bed of gravel. The time required for the water level in the barrel to drop by $0.75m$

is

a) $58.9s$
b) $75s$
c) $100s$
d) $150s$

13) The ultimate load capacity of a $10m$ long concrete poilre of square cross section $500mmx500mm$ driven into a homogeneous clay layer having undrained conhesion value of $40kPa$ is $700kN$. If the cross section of the pile is reduced to $250mmx250mm$ and the length of the pile is increased to $20m$, the ultimate load capacity will be

a) $350kN$
b) $632.5kN$
c) $722.5kN$
d) $1400kN$