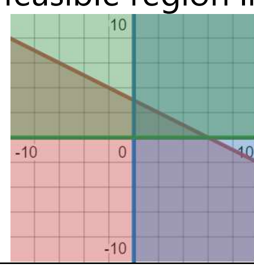
ANSWER KEY WITH HINTS OF
DOE PRACTICE PAPER – 1 (TERM – 1) (SESSION 2021 – 22)
CLASS XII
MATHEMATICS (CODE: 041)

	SECTION – A		
Q.NO.	**CORRECT OPTION**	**HINT/MAIN POINTS**	**MARKS**
1.	(d)	$As, \tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}$ $so, f(x) = \frac{\pi}{2}$ Thus range of f(x) is $\{\frac{\pi}{2}\}$	1
2.	(d)	$\sec^{-1}(2) + \sin^{-1}(\frac{1}{2}) + \tan^{-1}(-\sqrt{3}) = \frac{\pi}{3} + \frac{\pi}{6} - \frac{\pi}{3}$ $= \frac{\pi}{6}$	1
3.	(a)	Not Reflexive as (c,c) $\notin$ R, By definition, R is symmetric as well as Transitive	1
4.	(b)	As (2, 2) $\notin$ R, so R is not Reflexive As (2, 3) ε R, (3, 2) ε R but (2, 2) $\notin$ R, so R is not Transitive By definition, R is symmetric.	1
5.	(d)	As, |adj A| = $\|A\|^2$ = 265, so |A| = 16 or – 16 Thus, the sum of all possible values of |A| is zero.	1
6.	(d)	$\begin{bmatrix} x-2 & 5+y \end{bmatrix} \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = O$ $\Rightarrow \begin{bmatrix} 5+y & x-2 \end{bmatrix} = O = \begin{bmatrix} 0 & 0 \end{bmatrix}$ On Comparing, y = - 5, x = 2, so x + y = - 3	1
7.	(b)	$Let, A = \begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix} \Rightarrow A^2 = \begin{bmatrix} a^2 & 0 & 0 \\ 0 & b^2 & 0 \\ 0 & 0 & c^2 \end{bmatrix}$ $As\ A^2 = A \Rightarrow \begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix} = \begin{bmatrix} a^2 & 0 & 0 \\ 0 & b^2 & 0 \\ 0 & 0 & c^2 \end{bmatrix}$ So, a = 0 or – 1, similarly b and c can take 2 values (0 and -1) Thus, total number of possible matrices are 2 x 2 x 2 = 8	1

8.	(d)	$\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix} + \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix},$ $\Rightarrow \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 2 & 5 \\ 3 & 3 \end{bmatrix}$ $Thus, a + c - b - d = 5 - 5 - 3 = -3$	1
9.	(c)	As, $(A - A^T)^T = -(A - A^T)$ So, $(A - A^T)$ is not Symmetric matrix,	1
10.	(d)	$\lvert 2A^T \rvert = 2^3 \lvert A^T \rvert = 8\,\lvert A \rvert = 24$	1
11.	(d)	$y = \frac{x^a}{x^a + x^b + x^c} + \frac{x^b}{x^a + x^b + x^c} + \frac{x^c}{x^a + x^b + x^c} = \frac{x^a + x^b + x^c}{x^a + x^b + x^c},$ Thus, $y = 1 \Rightarrow \frac{dy}{dx} = 0$	1
12.	(c)	By definition, 3 x 5 = a x b = c x d, thus a = c = 3 and b = d = 5 Thus, ac + bd = 9 + 25 = 34	1
13.	(a)	Continuous function as LHL = RHL = f(4) = 11 But not differentiable as LHD $\neq$ RHD (LHD = 2, RHD = 8)	1
14.	(c)	If $x^3 - 3x^2y + y^3 = 2021 + xy$ then $3x^2 - 3(x^2\frac{dy}{dx} + 2xy) + 3y^2\frac{dy}{dx} = x\frac{dy}{dx} + y$ $\Rightarrow \frac{dy}{dx} = \frac{y + 6xy - 3x^2}{3y^2 - 3x^2 - x}$	1
15.	(d)	$y = x^3 \Rightarrow$ Slope of tangent = $3x^2$ at the point (2, 8) Slope of tangent at the point (2, 8) is 3(4) = 12	1
16.	(b)	Z at (3, 0) = 3p, Z at (1, 1) = p + q As Z is minimum at both the points so 3p = p + q $\Rightarrow$ **2p = q**	1
17.	(b)	$8x + 18y\frac{dy}{dx} = 0 \Rightarrow \frac{dy}{dx} = \frac{-4x}{9y} = 0$ Thus, x = 0, so 0 + $9y^2$ = 36 $\Rightarrow$ y = ±2 Point on the curve is (0, ±2)	1
18.	(b)	$As, \frac{dy}{dx} = -3x^2 + 6x = -3x(x-2)$ $so, \frac{dy}{dx} = +ve\ in\ (0,2)$	1

19.	(d)	$y = e^x \Rightarrow \frac{dy}{dx} = e^x, \frac{d^2y}{dx^2} = e^x$ $so, \frac{d^2y}{dx^2} - 2\frac{dy}{dx} = e^x - 2e^x = -e^x = -y$	1
20.	(d)	$\frac{dy}{dt} = 3\cos^2 t.(-\sin t), \frac{dx}{dt} = 3\sin^2 t.(\cos t)$ $\frac{dy}{dx} = \frac{-3\cos^2 t.\sin t}{3\sin^2 t.\cos t} = -\cot t$	1
SECTION – B			
21.	(b)	$\cos^{-1} x + \cos^{-1} y = \pi - (\sin^{-1} x + \sin^{-1} y) = \pi - \frac{2\pi}{3} = \frac{\pi}{3}$	1
22.	(a)	As f(x) = f(y) ⇒ x = y, so f(x) is one-one function And as range of f is R = co-domain, so f is onto function **Alternative method**: Graph of f(x) is a line which is strictly increasing for all values of x, so its on-one function and Range of f(x) is R which is equal to R so oto function.	1
23.	(c)	$As, a \not> a, So$ R is not reflexive $As, a > b$ does not implies b > a, So R is not symmetric $As\ a > b, b > c \Rightarrow a > c,$ So R is Transitive	1
24.	(a)	we know that, $\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$ $and\ \frac{-\pi}{2} \le \sin^{-1} x \le \frac{\pi}{2},$ $so, 0 \le \sin^{-1} x + \frac{\pi}{2} \le \pi \Rightarrow 0 \le 2\sin^{-1} x + \cos^{-1} x \le \pi$ Thus $a = 0, b = \pi$	1
25.	(b)	$A^{-1} = \begin{bmatrix} 3 & 1 & 2 \\ 0 & 1 & 2 \\ 0 & 2 & 1 \end{bmatrix} \Rightarrow \|A^{-1}\| = -9$ $Thus, \|A\| = \frac{-1}{9}. so, \|adjA\| = \|A\|^2 = \frac{1}{81}$	1
26.	(d)	A^2 = A.A = AB.A = A.B = A B^2 = BB = BA.B = B.A = B (A + B)(A – B) = A^2 + BA – AB – B^2 = A + B – A – B = 0	1

27.	(d)	$5^x + 5^y = 5^{x+y} \Rightarrow 5^{-y} + 5^{-x} = 1$ $-(5^{-y}\log 5)\frac{dy}{dx} + -(5^{-x}\log 5) = 0 \Rightarrow \frac{dy}{dx} = -5^{y-x}$	1
28.	(b)	$f'(x) = 6x^2 - 6x - 36 = 6(x-3)(x+2)$ Thus, f(x) is decreasing in (- 2, 3)	1
29	(d)	As curves cut orthogonally at (1,1), so (1,1) must satisfy $ay + x^2 = 7$. Thus $a(1) + 1 = 7 \Rightarrow a = 6$	1
30.	(a)	$As, \frac{x^2 - y^2}{x^2 + y^2} = e^a$ $\Rightarrow \frac{(x^2+y^2)(2x-2yy') - (x^2-y^2)(2x+2yy')}{(x^2+y^2)^2} = 0$ $\Rightarrow 4xy^2 = 4x^2yy' \Rightarrow \frac{dy}{dx} = \frac{y}{x}$	1
31.	(a)	By definition of area of triangle, $\lvert -3(-k)+3(k)\rvert = 18$ $k = \pm 3$	1
32.	(d)	$As, \begin{bmatrix} x+y+z \\ y+z \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 3 \\ 2 \end{bmatrix}, then\ z = 2, y+z = 3, x+y+z = 6$ $Thus, z = 2, y = 1, x = 3 \Rightarrow 2x + y - z = 5$	1
33.	(b)	$As, y = \tan^{-1} x, then \frac{dy}{dx} = \frac{1}{1+x^2}$ and $\frac{d^2y}{dx^2} = \frac{-2x}{(1+x^2)^2} \Rightarrow \left.\frac{d^2y}{dx^2}\right\rvert_{x=1} = \frac{-2}{4}$ $Thus, 4\frac{d^2y}{dx^2} = -2$	1
34.	(b)	As, $2A^2 + A = I$, on pre-multiplying by A^{-1}, we get $2A + I = A^{-1}$	1
35.	(a)	Since f(x) = 2sin 2x, Value of sin 2x lies between – 1 to 1, so maximum value of f(x) is 2	1
36.	(c)	At (1, 4), $13 = a(1) + 4 \Rightarrow a = 9$	1
37.	(b)	As, $(L_1, L_1) \notin R$ (Every line coincides at all points with itself) So, R is not Reflexive. As, $(L_1, L_2) \in R$ implies $(L_2, L_1) \in R$, So, R is Symmetric.	1

		As, (L_1,L_2) ε R, (L_2,L_3) ε R does not implies (L_1,L_3) ε R, So, R is not Transitive. (For example In case of two parallel lines L_1, L_3 intersect by a line L_2)	
38.	(c)	As for 3 and 4 from set X we have same image c in set Y, so f is not one-one function. Further element d has no pre-image in set X, so f is not onto function.	1
39.	(a)	The feasible region for an LPP is always a convex polygon (In general, the feasible region of a Linear Programming Problem (LPP) is the intersection of the half-spaces which are defined by the hyper planes. From this observation, we can conclude that the feasible region of an LPP is always a convex polygon)	1
40.	(b)	y ' = e^x , slope of tangent at (0, 1) = 1 Thus, equation of tangent is y – 1 = x which intersect the x-axis at x = -1, so the required point is (- 1, 0)	1
SECTION – C			
41.	(a)	From the graph, The feasible region lies in First Quadrant 	1
42.	(b)	For f(x) = cos x, f′ (x) = - sin x which is negative on $(0,\frac{\pi}{2})$ So, cos x is decreasing function on $(0,\frac{\pi}{2})$	1
43.	(d)	f ′ (x) = cos x – a, so f (x) is decreasing on x ε R, when a ε [1, ∞) because cos x ≤ 1	1
44.	(c)	In a linear programming problem, If the feasible region is bounded then objective function Z = px + qy has Maximum and minimum value both.	1
45.	(d)	$A=\begin{bmatrix}6x & 8\\ 3 & 2\end{bmatrix} \Rightarrow \lvert A\rvert = 12x-24=0 \Rightarrow x=2$	1
46.	(c)	$\frac{C}{t}=kv^2, so\ 48 = k(16)^2. Thus, 16k=3$	1

47.	(d)	$\frac{C}{t}=\frac{3}{16}v^2+1200$ $\Rightarrow C=\frac{3}{16}v^2t+1200t=\frac{3}{16}v^2(\frac{1000}{v})+1200(\frac{1000}{v})$ $C=\frac{375}{2}v+\frac{1200000}{v}.$	1
48.	(b)	$\frac{dC}{dv}=\frac{375}{2}-\frac{1200000}{v^2}=0\Rightarrow v=80$ $\frac{d^2C}{dv^2}=positive$ at $v=80$	1
49.	(a)	The fuel cost (In Rs.)for the train to travel 1000km at the most economical speed is $C=\frac{375}{2}v=\frac{375}{2}(80)=15000$	1
50.	(b)	The total cost of the train to travel 1000km at the most economical speed is $C=\frac{375}{2}v+\frac{1200000}{v}=15000+\frac{1200000}{80}$ $C=30000$	1