KENDRIYA VIDYALAYA SANGATHAN, ERNAKULAM REGION
FIRST PRE-BOARD EXAMINATION (2026 – 27)
CLASS XII
SUBJECT: MATHEMATICS SUBJECT CODE 041

MARKING SCHEME

No.	MARKING SCHEME /ANSWER KEY	Split-up of marks	Marks
	SECTION A		
1	(b) Symmetric		1
2	(c) [0,1]		1
3	(d) -1		1
4	(b) x = 2, y = 0		1
5	(d) -4		1
6	(b)-1		1
7	(c) 1		1
8	(c) 0		1
9	(a) log 2		1
10	(d) $\frac{e^{x^3}}{3}$ + C		1
11	(b) 9/4		1
12	(b) $80\pi\ cm^2/s$		1
13	(d) 0		1
14	(a) 4		1
15	(c) 2		1
16	(b) 2p = q		1
17	(c) 16		1
18	(b) 2		1
19	(b) Both A and R are true, but R is not the correct explanation of A.		1
20	(a) Both A and R are true, and R is the correct explanation of A.		1
	SECTION B		
21	Base AB=6 and height=|k|. Area = ½×6×|k|=3|k|=9 ⇒ |k|=3. Therefore, k=3 or k=−3. Marking: 1 mark for area equation; 1 mark for k=±3.		2
22	For continuity, =f(3)=lim(x→3+)f(x). $\lim_{x\to 3^-} f(x) = f(3) = \lim_{x\to 3^+} f(x)$ Left Lim =3a+1; right limit=3b+3. 3a+1=3b+3 ⇒ a−b=2..	1 1	2
23	Let u = 1 + sin 6x, Differentiating both sides with respect to x du=6cos 6x dx		2

	Substitute and integrate Get the answer as $$\frac{1}{9}(1+\sin 6x)^{3/2}+C$$ **OR** Use $\tan(\pi/4-x)=(1-\tan x)/(1+\tan x)$ $=(\cos x-\sin x)/(\cos x+\sin x)$. $I=\tan^{-1}(\tan(\pi/4-x))$. $\int(\pi/4-x)\,dx$. $=\pi x/4-x^2/2+C$	1 1 1 1	
24	Since $1+\cos 2x=2\cos^2 x$ and $\sin 2x=2\sin x\cos x$, the fraction becomes $\sec^2 x+\tan x$. $$\int(\tan x+\sec^2 x)\,e^x dx$$ Therefore, integral = $e^x \tan x + C$. Marking: 1 mark for simplification; 1 mark for final integration. **OR** Put $u=\cos^2 x$, so $du=-\sin 2x\,dx$. $\cos^4 x=u^2$, hence $\int\frac{-du}{\sqrt{9-u^2}}$ $\int\frac{-du}{\sqrt{3^2-u^2}}$ $=\int\frac{-du}{\sqrt{3^2-u^2}}=-\sin^{-1}\frac{u}{3}$ $=-\sin^{-1}\frac{\cos^2 x}{3}+C$	1 1 1	2
25	$\vec{a}=\hat{\imath}+2\hat{\jmath}+3\hat{k}$ and $\vec{b}=2\hat{\imath}+4\hat{\jmath}-5\hat{k}$ Diagonals are $\vec{a}+\vec{b}=3\hat{\imath}+6\hat{\jmath}-2\hat{k}$ and $\vec{a}-\vec{b}=-\hat{\imath}-2\hat{\jmath}+8\hat{k}$ and $\vec{b}$ | a + b | = 7; |a−b|=√69. Unit vectors: (3i+6j−2k)/7 and (−i−2j+8k)/√69 (and their negatives are also parallel).	1 1	2
	SECTION C		
26	Choose α such that cosα=3/5 and sinα=4/5; hence $\alpha=\tan^{-1}(4/3)$. $(3/5)\cos x+(4/5)\sin x=\cos(x-\alpha)$. Therefore the expression is $\cos^{-1}[\cos(x-\tan^{-1}(4/3))]$. On the relevant principal-value interval this reduces to $x-\tan^{-1}(4/3)$.	1 1 1	3
27	$A^2=\begin{bmatrix}1 & 0\\ -6 & 25\end{bmatrix}$ and $6A+kI=\begin{bmatrix}6+k & 0\\ -6 & 30+k\end{bmatrix}$ Solve for k Thus k=−5. Marking: 1 mark for A^2; 1 mark for comparison; 1 mark for k = −5.	1 1 1	3

28	$y'=\frac{2sin^{-1}x}{\sqrt{1-x^2}}$ $y'\sqrt{1-x^2}= 2sin^{-1}x$ $y'\frac{-x}{\sqrt{1-x^2}} + y''\sqrt{1-x^2} = \frac{2}{\sqrt{1-x^2}}$ multiply throughout by $\sqrt{1-x^2}$ $(1-x^2)y''-xy' = 2$, hence proved **(OR).** $dx/d\theta=3a\sin^2\theta\cos\theta$ and $dy/d\theta=-3b\cos^2\theta\sin\theta$. $dy/dx=-(b/a)\cot\theta$. $d^2y/dx^2 = \frac{b}{(3a^2\sin^4\theta\cos\theta).}$ At $\theta=\pi/4$: $d^2y/dx^2=\frac{4\sqrt{2}b}{3a^2}$	1 1 1 1 1 1	3
29	Let t = sinx – cos x dt = (sinx+cosx)dx squaring , the denominator becomes $=25 - 9t^2$ limits 0 to $\pi/4$ becomes t = -1 to 0 $\int_{-1}^{0} \frac{dt}{5^2-9t^2}$ Use formula and substitute to get final answer as $\frac{1}{15}\log 2$ OR Put t=sinx, dt=cosx dx. Integral = $\int 2dt/[(1-t)(1+t^2)] = \int[(t+1)/(t^2+1) - 1/(t-1)]dt$. Therefore answer = $\frac{1}{2}\ln(1+t^2)+\tan^{-1}t-\ln\lvert t-1\rvert+C$. Substitute t=sinx: $\frac{1}{2}\ln(1+\sin^2x)+\tan^{-1}(\sin x)-\ln\lvert 1-\sin x\rvert+C$.	1.5 1.5 1 1 1	3
30	$a + \lambda b=(2-\lambda)i+(2+2\lambda)j+(3+\lambda)k$. $c=3i+j$, so $(a+\lambda b)\cdot c=3(2-\lambda)+(2+2\lambda)=8-\lambda$. Perpendicular $\Rightarrow 8-\lambda=0 \Rightarrow \lambda=8$.	1 1 1	3
31	Boundary intersections give feasible vertices: (0,10), (5,5), (15,15), (0,20). Z values: 90, 60, 180, 180 respectively. Minimum Z=60 at (5,5); maximum Z=180 at both (15,15) and (0,20).	1 1 1	3
	SECTION D		
32	Given A = $\begin{bmatrix}1 & 2 & -3\\ 3 & 2 & -2\\ 2 & -1 & -1\end{bmatrix}$ det(A) = 15. adj(A)= $\begin{bmatrix}-4 & 5 & 2\\ -1 & 5 & -7\\ -7 & 5 & -4\end{bmatrix}$ $A^{-1} = \frac{1}{15}\begin{bmatrix}1 & 2 & -3\\ 3 & 2 & -2\\ 2 & -1 & -1\end{bmatrix}$	1 2 +1	5

	$X = \frac{1}{15}\begin{bmatrix}1 & 2 & -3\\ 3 & 2 & -2\\ 2 & -1 & -1\end{bmatrix}\begin{bmatrix}6\\3\\5\end{bmatrix}$ $x = -\frac{62}{15}$ $y = \frac{14}{3}$ $z = -\frac{29}{15}$	1 1	
33	Sketch curve and Rewrite as $y=2\sqrt{9-x^2}$ with $-3 \le x \le 3$. Total area $= 4\int_0^3 \sqrt{3^2-x^2}\,dx$ Use the formula Apply limits Answer: 18π square units.	1 1 1 1 1	5
34	Divide by $1+x^2$: $y'+\frac{2x}{(1+x^2)}y=\frac{1.}{(1+x^2)^2}$ Integrating factor $= e^{\{\int 2x/(1+x^2)dx\}}=1+x^2$. Thus solution is $d[(1+x^2)y]/dx=1/(1+x^2)$. Integrating: $(1+x^2)y=\tan^{-1}x+C$. At $x=1, y=0$: $C=-\pi/4$. Hence $y=[\tan^{-1}x-\pi/4]/(1+x^2)$. **OR** Put $v=y/x$, so $y=vx$ and $y'=v+xv'$. Substitution gives $x^2v'\sin v+x=0 \Rightarrow \sin v\,dv=-dx/x$. Integrate: $-\cos v=-\ln x+C$, so $\cos v=\log x+C_1$. At $x=1$, $v=\pi/2$, hence $C_1=0$. Therefore $\cos(y/x)=\log x$.	1 1 1 1 1 1 1 1 1 1	5
35	Convert the equation in the standard form $\frac{x+2}{5}=\frac{y+1}{2}=\frac{z-4}{3}=\lambda$ any point on it Q $(5\lambda-2, 2\lambda-1, 3\lambda+4)$ Direction ratios of PQ $5\lambda-3, 2\lambda-2, 3\lambda$ Apply condition for perpendicularity and get $\lambda = 1/2$ Substitute and get the point (1/2, 0, 11/2) **OR** Let common parameter point on the line $(1+3t, -1+2t, 4+3t)$. Distance from $(-1,-1,2)$: $(2+3t)^2+(2t)^2+(2+3t)^2$. Equate the same with $(2\sqrt{2})^2$ ie $2(2+3t)^2+4t^2=8$. $11t^2+12t=0 \Rightarrow t=0$ or $t=-12/11$. Points: $(1,-1,4)$ and $(-25/11,-35/11,8/11)$.	1 1 1 1 1 1 1 1 1 1	5
	SECTION E		
36	1. $4\hat{i}+5\hat{j}-2\hat{k}$ (1) 2. (5, 1, 2) (1) 3. PR=√14; RQ = √11. Total distance=√14+√11. **OR**: Unit vector along PQ=(4i+5j−2k)/√45=(4i+5j−2k)/(3√5). [2]		4
37	(i) Square perimeter=x ⇒ 4a=x ⇒ a=x/4. Circle circumference=28−x ⇒ 2πr=28−x ⇒ r=(28−x)/(2π). [1] (ii) $A(x)=a^2+\pi r^2=x^2/16+(28-x)^2/(4\pi)$. [1]		4

	(iii) $A'(x)=x/8-(28-x)/(2\pi)$. Set $A'(x)=0$: $\pi x=4(28-x)$. Hence $x=112/(\pi+4)$. Wire for circle $=28-x=28\pi/(\pi+4)$. Since $A''(x)=1/8+1/(2\pi)>0$, this gives the minimum. Answer: square wire$=112/(\pi+4)$ m; circular wire$=28\pi/(\pi+4)$ m. [2]		
38	(i) There are only 10 possible last digits: 0,1,…,9. Thus A is partitioned into at most/at most 10 last-digit classes; the relation groups customers according to the same last digit. The classes are $A_0,A_1,\ldots,A_9$, where $A_i=\{x\in A$: last digit of x is i$\}$. Empty classes may occur. [2] (ii) Reflexive: every customer has the same last digit as itself. Symmetric: if x and y have the same last digit, y and x also have the same last digit. Transitive: if x and y have the same last digit and y and z have the same last digit, then x and z have the same last digit. Hence R is an equivalence relation. [2] **OR**: R_1 is not an equivalence relation because it is not reflexive (a digit cannot be one more than itself); it is also not symmetric. Hence it fails the required properties. [2]		4