1. Ans. D.

We have R = {(x,y) :x ∈ N, y ∈ N, 2x + y = 41}
Domain = {1,2,3,.....,20} {∵ y ∈ N}
∴ R = {(1,39),(2,37),(3,35),....,(19,3),(20,1)}
∴ Range = {1,3,5,....,39}
R is not reflexive as (2, 2) ∉ R as 2×2+2≠41
Also R is not symmetric
as (1,39) ∈ R but (39,1) ∉ R
Further R is not transitive.
as (11,19) ∉ R, (19,3) ∉ R ; but (11,3) ∉ R
Hence, R is neither reflexive, nor symmetric and nor transitive.

2. Ans. A.

cos 24° + cos 55° + cos (180-35)° + cos (180-24)° + cos(270+30)°

cos 24° + cos 55° – cos 55° – cos 24° + sin 30°

sin 30°=$\frac{1}{2}$

3. Ans. C.

$\sec^{-1}\frac{x^2+1}{x^2-1}$

Put x=tanθ

$\sec^{-1}\frac{\tan^2\theta+1}{\tan^2\theta-1}=\sec^{-1}(\frac{\sec^2\theta}{-\cos2\theta})=\sec^{-1}(-\sec2\theta)$

=π-$\sec^{-1}(\sec2\theta)$ = π-2θ = π-2$\tan^{-1}x$

4. Ans. B.

Given equation, $9x^2 - 16y^2 = 144$ can be written as,

$\frac{x^2}{16}-\frac{y^2}{9}=144$

As we know that $b^2=a^2(e^2-1)$

9=16(e^2-1)

e=$\frac{25}{16}$=$\frac{5}{4}$

so the foci is (±ae,0)= (±5,0)

5. Ans. A.

Taking A(12, 8), B(-2, 6) & C(6, 0)

$AB^2 = (12-2)^2 + (8-6)^2$=196+4=200

$AC^2 = (12-6)^2 + (8-0)^2$=36+64=100

$BC^2 = (-2-6)^2 + (6-0)^2$=64+36=100

By Pythagoras, $AB^2 = AC^2 + BC^2$, the points A(12, 8), B(-2, 6) & C(6, 0) are vertices of right angled triangle

AB is a hypotenuse.

Mid-point of AB, ($\frac{12+2}{2}$, $\frac{8+6}{2}$) = (5,7)

Let the mid-point be M(5,7)

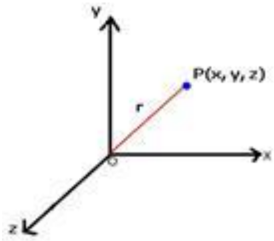
AM=$\sqrt{(12-5)^2+(8-7)^2} = \sqrt{49+1} = \sqrt{50} = 5\sqrt{2}$

MB=$\sqrt{(5-(-2))^2+(7-6)^2} = \sqrt{49+1} = \sqrt{50} = 5\sqrt{2}$

AM=MB=$5\sqrt{2}$

So mid point is equidistant from the angular points so, the triangle is Isosceles Right angle triangle.

6. Ans. C.



Point in xy-plane will only having coordinates of x and y plane the z component will always be zero.

7. Ans. B.

$(6 + 5i)^2$ = 36+60i-25=11+60i

And the conjugate of this function is 11-60i.

8. Ans. B.

We know that, C(n,r)+ C(n,r-1)= C(n+1,r)

So,($C(n,r) + C(n,r - 1)) + (C(n,r - 2) + C(n,r - 1))$

C(n+1,r)+C(n+1,r-1)=C(n+2,r)

9. Ans. A.

As we know that nth term of G.P. is ar^{n-1}

So, a=2, and r=2

Then the sequence will be 2,4,8,16,32…..

Sum of its first six terms= $2(2^6 - 1) =$ 126

10. Ans. D.

As we know that general term= C(6,r). $3x^{6-r} . (\frac{-1}{x})^r$

C(6,r). $3^{6-r} . x^{6-2r}$

So, 6-2r=2 then r=2

Again, C(6,2). $3^{6-2} . x^2$ =15×81x^2

So the coefficient of x^2 is 1215.

11. Ans. B.

$\begin{vmatrix} 0 & c & b \\ c & 0 & a \\ b & a & 0 \end{vmatrix}^2 = [0(0-a^2)-c(0-ab)+b(ac-0)]^2 = [abc+abc]^2 = (2\text{abc})^2$
$= 4\text{a}^2\text{b}^2\text{c}^2$

12. Ans. A.

First determinant of matrix $|A| = \begin{matrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{matrix} = 1$

So, determinant of A is not zero then inverse of A is

$A^{-1} = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} = A$

13. Ans. D.

$$\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix} = ?$$

$R_1 \to R_1 + R_2 + R_3$

$$\begin{vmatrix} 1+w+w^2 & 1+w+w^2 & 1+w+w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{vmatrix}$$

We know that w is cube root of unity then $1+w+w^2=0$

$$\begin{vmatrix} 0 & 0 & 0 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{vmatrix}$$

If one row is completely zero then the determinant will be zero.

14. Ans. C.

$$\lim_{x\to 0} \frac{\sin(2+x)-\sin(2-x)}{x} = ?$$

$$\lim_{x\to 0}\frac{sin2cos2x + cos2sin2x - (sin2cos2x - cos2sin2x)}{x}$$

$$\lim_{x\to 0}\frac{2cos2sin2x}{x}$$

$$\lim_{x\to 0}\frac{2cos2.2sinxcosx}{x}$$

$$4\cos 2\lim_{x\to 0}\frac{\sin x}{x}\cos x$$

4cos2

15. Ans. D.

Sec(x)+tan(x)

=(1+sin x)/cos x

=(Cos x/2 +sin x/2)/(cos x/2 - sin x/2)

=(Tan x/2 + tanπ/4)/(1-tan x * tan π/4)

=Tan(π/4 +x/2)

So given equation becomes

Tan^{-1}(sec x + tan x)

=Tan^{-1}(tan(π/4 + x/2))

=π/4 + x/2

Now by differentiating it w.r.t x we'll get ½.

16. Ans. C.

$$\sqrt{x+y}+\sqrt{y-x}=c.$$

squaring on both sides,

x+y + y-x + 2× $\sqrt{(x+y)(y-x)}$= c^2

$x+y + y-x + 2\times\sqrt{(y^2 - x^2}= c^2$

$2\times\sqrt{(y^2 - x^2}= c^2 - 2y$

squaring on both sides,

$4(y^2 - x^2) = c^4 + 4y^2 - 4c^2y$

$-4x^2 = c^4 - 4c^2y$

$y = (c^2/4) + (x^2)/c^2$

$dy/dx = (2x)/c^2$

$d^2 y/dx^2 = 2/c^2$

17. Ans. A.

Given: da/dt=3cm/s and a=10cm

Volume of the cube =a3

Differentiating w.r.t t on both sides we get,

$dv/dt=3a^2\ da/dt$

Substituting a and da/dt

$dv/dt=3\times10\times10\times3=900cm^3/sec$

18. Ans. D.

$s = t^3 - 4t^2 + 5$

$v=\frac{ds}{dt}=3t^2 -8t$

$a=\frac{dv}{dt}=6t-8$

As the acceleration vanishes so, 6t-8=0 so, t=4/3

$v= 3\times\frac{16}{9}-8\times\frac{4}{3}=-16/3$

19. Ans. D.

To calculate Standard deviation, we fist calculate Variance

SD=$\sqrt{variance}$

Variance= $\frac{\sum(x_i-\bar{x})^2}{n}$

here x is a mean.

so $\bar{x} = \frac{8+12+13+15+22}{5}$ =14

For variance, calculate $x_i - \bar{x}$,for each value of xi

8-14=-6

12-14=-2

13-14=-1

15-14=1

22-14=8

Variance= $\frac{36+4+1+1+64}{5}$ =106/5=21.2

Standard deviation=$\sqrt{21.2} = 4.6$

20. Ans. C.

N(s) = (HHH,HHT,HTH,THH,TTT,HTT,THT,TTH)
= (8)
Let A be probability for getting 1 or 2 head
n(A)=6
P(A)=n(A)/n(s)=6/8=3/4

21. Ans. B.

Given, position vector A=60i+3j

position vector B=40i-8j

position vector C=aj-52j

Now, find vector AB and BC

AB= -20i-11j

BC= (a-40)i-44j

To be collinear, angle between the vector AB and BC made by the given position vectors should be 0 or 180 degree.

That's why the cross product of the vectors should be zero

ABXBC=(-20i-11j)X(a-40)i-44j

0i+0j+(880+11(a-40))=0

a-40= -80

a=-40

Therefore, 'a' should be -40 to be the given positions vectors collinear.

22. Ans. D.

$$\int_{\frac{\pi}{3}}^{\frac{\pi}{3}} \sin^2 x\, dx = \int_{\frac{\pi}{3}}^{\frac{\pi}{3}} \frac{1-\cos 2x}{2}\, dx = \int_{\frac{\pi}{3}}^{\frac{\pi}{3}} \frac{1}{2}\, dx - \int_{\frac{\pi}{3}}^{\frac{\pi}{3}} \frac{\cos 2x}{2}\, dx = \left[\frac{x}{2}\right]_{\frac{\pi}{3}}^{\frac{\pi}{3}} - \left[\frac{\sin 2x}{2}\right]_{\frac{\pi}{3}}^{\frac{\pi}{3}} =$$

$$\frac{1}{2}\left[\frac{\pi}{3} - \frac{\pi}{3}\right] - \frac{1}{2}\left[\sin\frac{2\pi}{3} - \sin\frac{2\pi}{3}\right] = 0$$

23. Ans. A.

$$\int \frac{\cos 2x}{\cos^2 x . \sin^2 x}\, dx$$

$$\int \frac{\cos^2 x - \sin^2 x}{\sin^2 x \cos^2 x}\, dx$$

$$\int \frac{1}{\sin^2 x} - \frac{1}{\cos^2 x} dx$$

$$\int \operatorname{cosec}^2 x - \sec^2 x dx$$

$$\int \operatorname{cosec}^2 x dx - \int \sec^2 x\, dx$$

-cotx-tanx+C

24. Ans. C.

$\frac{dy}{dx} = e^{x+y} + x^2 e^y$.

$$\frac{dy}{dx} = e^x e^y + x^2 e^y$$

$$\frac{1}{e^y} dy = (e^x + x^2) dx$$

Integrating both the sides,

$-e^y = e^x + \frac{x^3}{3} + C$

$$e^x + e^y + \frac{x^3}{3} = C$$

25. Ans. B.

$y^2 = 2y - x$ & y – axis hence x=0

$y^2 = 2y$

$y^2 - 2y = 0$

y(y-1)=0

y=0 and y=2

$y^2 = 2y - x$ can be written as $(y-1)^2 = -(x-1)$

x=1-$(y-1)^2$

Area under y curve = $\int_0^2 x dy = \int_0^2 1 - (y-1)^2 = (y - \frac{(y-1)^3}{3})_0^2 = \frac{4}{3}$