MATHS

JEE (MAIN AND ADVANCED)

MATHEMATICS

STRAIGHT LINES (3D)

Exercise I

1. Equation of line passing through the points (1,2,3) ,(2,-1,2) is

A. $\frac{x-2}{2}=\frac{y-2}{-1}=\frac{z-3}{2}$

B. $\frac{x-1}{2}=\frac{y-2}{-3}=\frac{z-3}{-1}$

C. $\frac{x-2}{1}=\frac{y+1}{2}=\frac{z-1}{3}$

D. none

Answer: D

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2. Equation of the line passing through the point (1, -2, 5) and having d.r's 1, 2, 3 is

A. $\frac{x-1}{1}=\frac{y+2}{2}=\frac{z-5}{3}$

B. $\frac{x+1}{1}=\frac{y-2}{2}=\frac{z+5}{3}$

C. $\frac{x-1}{3}=\frac{y+2}{2}=\frac{z-5}{1}$

D. $\frac{x+1}{1}=\frac{y-2}{-2}=\frac{z-3}{5}$

Answer: A

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3. Equation of the line through (-1,2,3) and parallel to $\frac{x-4}{2}=\frac{y+1}{-3}=\frac{z+10}{8}$ is

A. $\frac{x-1}{2}=\frac{y-3}{-3}=\frac{z-3}{8}$

B. $\frac{x+1}{2}=\frac{y-2}{-3}=\frac{z-3}{8}$

C. $\frac{x-4}{-1}=\frac{y+1}{2}=\frac{z+10}{3}$

D. none

Answer: B

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4. Equation of a line passing through (-1, 2, -3) and perpendicular to the plane 2x + 3y + z + 5=0 is

A. $\frac{x-1}{-1}=\frac{y+2}{1}=\frac{z-3}{-1}$

B. $\frac{x+1}{-1}=\frac{y-2}{1}=\frac{z+3}{1}$

C. $\frac{x+1}{2}=\frac{y-2}{3}=\frac{z+3}{1}$

D. none

Answer: C

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5. The angle between the lines

$\frac{x-1}{2}=\frac{y-2}{1}=\frac{z+3}{2}$ and $\frac{x}{1}=\frac{y}{1}=\frac{z}{0}$

is

A. 0°

B. 30°

C. 45°

D. 90°

Answer: C

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6. If angle θ between the line $\frac{x+1}{1} = \frac{y-2}{2} = \frac{z-2}{2}$ and the plane

$2x - y + \sqrt{\lambda}z + 4 = 0$ is such that $\sin\theta = \frac{1}{3}$ then the value of λ is

A. $3/4$

B. $-4/3$

C. $5/3$

D. $-3/5$

Answer: C

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7. The lines $\frac{x-2}{1} = \frac{y-3}{2} = \frac{z-4}{0}$ is

A. parallel to x-axis

B. parallel to y-axis

C. parallel to z-axis

D. lies in a plane parallel to xy-plane

Answer: D

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8. The line $\frac{x+3}{3} = \frac{y-2}{-2} = \frac{z+1}{1}$ and the plane 4x+5y+3z-5=0 intersect at a point

A. (3,1,-2)

B. (3,-2,1)

C. (2,-1,3)

D. (-1,-2,-3)

Answer: B

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9. Let the line $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+2}{2}$ lie in the plane x+3y-$\alpha z + \beta = 0$. Then (α, β) equals

A. (-6,7)

B. (5,-15)

C. (-5,5)

D. (6,-17)

Answer: A

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10. A straight line $\bar{r} = \bar{a} + \lambda\bar{b}$ meets the plane $\bar{r}.\bar{n} = 0$ at a point p. The position vector of 'p' is

A. $\bar{a} + \left(\frac{\bar{a}.\bar{n}}{\bar{b}.\bar{n}}\right)\bar{b}$

B. $\bar{a} - (\bar{b}.\bar{n})\bar{b}$

C. $\bar{a} - \left(\frac{\bar{a}.\bar{n}}{\bar{b}.\bar{n}}\right)\bar{b}$

D. $\bar{a} + (\bar{b}.\bar{n})\bar{b}$

Answer: C

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11. The distance between the line $\vec{r} = 2\hat{i} - 2\hat{j} + 3\hat{k} + \text{lambda}\left(\hat{i} - \hat{j} + 4\hat{k}\right)$ and the plane $\vec{r}.\left(\hat{i} + 5\hat{j} + \hat{k}\right) = 5$ is

A. $\frac{3}{10}$

B. $\frac{10}{3}$

C. $\frac{10}{9}$

D. $\frac{10}{\sqrt{3}}$

Answer: D

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12. The points in which the line $\frac{x-1}{1}=\frac{y-1}{-1}=\frac{z+3}{1}$ cuts the surface $x^2+y^2+z^2-20=0$

A. (0, 2, 4)

B. (0, 1, -4)

C. (4, -2, 0)

D. (0,-2,-4)

Answer: C

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13. The angle between the line

$$\frac{x-1}{2}=\frac{y-2}{1}=\frac{z+3}{-2}$$ and the plane x+y+4=0 is equal to

A. 0

B. $\pi/6$

C. $\pi/4$

D. $\pi/2$

Answer: C

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14. The equation

$$3x^2 - 2y^2 - 4z^2 + xy + xz + 6yz = 0$$

represents

A. A pair of straight lines

B. A pair of planes

C. represent a plane

D. a pair of planes through origin

Answer: D

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15. The symmetrical form of the line x - y + 2z = 5, 3x + y + z = 7 is

A. $\frac{4x-11}{-3}=\frac{4y+9}{3}=\frac{z}{1}$

B. $\frac{x-11}{-3}=\frac{y+9}{3}=\frac{z}{1}$

C. $\frac{4x-1}{3}=\frac{4y-9}{3}-\frac{z}{1}$

D. $\frac{x-3}{3}=\frac{y+2}{-5}=\frac{z}{-4}$

Answer: D

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16. The two lines x= ay+b, z=cy+d and $x = a^1y + b^1, y = c^1y + d^1$ are at right angles if

A. $aa^1 + c^1 + c = 0$

B. $aa^1 + bb^1 + cc^1 + 1 = 0$

C. $aa^1 + bb^1 + cc^1 = 0$

D. $\left(a + a^1\right)\left(b + b^1\right) + c + c^1 = 0$

Answer: A

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17. The length of the perpendicular from (1,6,3) to the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ is

A. 3

B. $\sqrt{11}$

C. $\sqrt{13}$

D. 5

Answer: C

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18. The foot of the perpendicular of the point (3,-1,11) to the line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ is

A. (2,5,7)

B. (2,3,4)

C. (0,2,3)

D. none

Answer: A

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19. The foot of the perpendicular of the point (3,-1,11) to the line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ is

A. (2, 5, 7)

B. (1, 11,3)

C. (0,0,0)

D. (0,2,3)

Answer: B

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20. The lines $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}$ and $\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}$ intersect if K equals

A. $\frac{3}{2}$

B. $\frac{9}{2}$

C. $\frac{-2}{9}$

D. $\frac{-3}{2}$

Answer: A

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21. The condition for lhe lines x=az+b, y=cz+d and $x = a_1z + b_1, y = c_1z + d_1$ to be parallel is

A. $\frac{a}{c} = \frac{a_1}{c_1} = 1$

B. $\frac{a}{a_1} = \frac{c}{c_1} = 1$

C. $\frac{a}{c_1} = \frac{a_1}{c} = 1$

D. $aa_1 + cc_1 + 1 = 0$

Answer: B

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22. The shortest distance between two lines

$$\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$$

and

$$\frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$$

is

A. $1/6$

B. $1/\sqrt{6}$

C. $1/\sqrt{3}$

D. $1/3$

Answer: B

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23. The lines $\frac{x-3}{1}=\frac{y-2}{2}=\frac{z-3}{-l}$ and $\frac{x-1}{l}=\frac{y-2}{2}=\frac{z-1}{4}$ are coplanar if value of l is

A. 2

B. 13

C. -13

D. -15

Answer: D

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24. The planes bx - ay = n, cy - bz = I, az - cx= m intersect in a line if

A. al-bm+cn=1

B. al+bm+cn=0

C. al-bm-cn+1=0

D. al+bm+cn=1

Answer: B

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25. If the planes x = cy + bz, y =az+cx and z = bx + ay pass through a line then

A. $a^2 + b^2 + c^2 + 2abc = 0$

B. $a^2 + b^2 + c^2 + 2abc = 1$

C. $a^2 + b^2 + c^2 = 2abc$

D. a+b+c=abc

Answer: B

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26. The cartesian equation of the plane passing through the line of intersection of the planes $r.\left(2\bar{i}+3\bar{j}+4\bar{k}\right)=l$ and $r.\left(\bar{i}-\bar{j}\right)+4=0$ and perpendi-cular to the plane $r.\left(2\bar{i}+\bar{j}+\bar{k}\right)+8=0$ is

A. 3x - 4y + 4z = 5

B. x- 2y + 4z = 3

C. x+14y+12z-23=0

D. 2x+3y+4=0

Answer: C

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27. The equation of the plane containing line $\frac{x-1}{3}=\frac{y+6}{4}=\frac{z+1}{2}$ and parallel to the line $\frac{x-2}{2}=\frac{y-1}{-3}=\frac{z+4}{5}$ is

A. 26x+ 11y-17z- 109=0 `

B. 26x+11y+17z+109=0

C. 26x-11y+17z-109=0

D. 26x-11y+17z+109=0

Answer: C

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28. Equation of plane containing the line $\frac{x-1}{-3}=\frac{y-3}{2}=\frac{z-2}{1}$ and the point (0,-3,4) is

A. x+y+2z-5=0

B. 2x-y+3z-15=0

C. 2x+y+4z=13

D. x+y-4z=13

Answer: C

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29. The direction ratios of a normal to the plane through (1, 0, 0), (0, 1, 0) which makes an angle of $\frac{\pi}{4}$ with the plane x+y=3 are

A. $(1, \sqrt{2}, 1)$

B. $(1, 1, \sqrt{2})$

C. (1,1,2)

D. $(\sqrt{2}, 1, 1)$

Answer: B

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30. A line with direction cosines proporional to 2,1,2 meets each of the lines x = y + a = z and x + a = 2y = 2z. The co-ordinates of' each of the points of intersection are given by

A. (3a,3a,3a). (a,a,a)

B. (2a,3a,3a),(2a,a,a)

C. (3a,2a,3a),(a,a,2a)

D. (3a,2a,3a),(a,a,a)

Answer: D

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31. If the straight lines

x=1 +s,y=-3$-\lambda s$, $z=1+\lambda s$ and $x=\frac{t}{2}$,y=t ,z=2-t with parameters s and t respectively are co planar then λ =

A. -2

B. 0

C. $\frac{-1}{2}$

D. -1

Answer: A

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32. Equation of the plane perpendicular to the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and passing through the point (2,3,4) is

A. x + 2y + 3z = 9

B. x+2y+3z=20

C. 2x+3y+z=17

D. 3x+2y+z=16

Answer: B

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33. The distance between the point (-1, -5, -10) and the point of intersection of the line $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-2}{12}$ with the plane x-y+z=5 is

A. 13

B. 26

C. 12

D. 15

Answer: A

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34. The plane passing through the point(-2,-2, 2) and containing the line joining the points (1, 1, 1) and (1, -1, 2) makes intercepts on the co-

ordinate axes, then sum of the lengths of intercepts is

A. 3

B. 4

C. 6

D. 12

Answer: D

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35. The line $\frac{x-2}{1}=\frac{y-3}{1}=\frac{z-4}{-k}$ and $\frac{x-1}{k}=\frac{y-4}{2}=\frac{z-5}{1}$ are coplanar if

A. k=0 or -1

B. k=1 or -1

C. k=0 or -3

D. k=3 or -3

Answer: C

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36. If the straight lines $\frac{x-1}{k}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x-2}{3}=\frac{y-3}{K}=\frac{z-1}{2}$ intersect at a point then the interger k is equal to

A. -5

B. 5

C. 2

D. -2

Answer: A

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37. Statement - 1 : The point A(1,0,7) is the mirror image of the point B(1,6,3) in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$

Statement -2 : The line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ bisects the line segment joining A (1,0,7) and B(1,6,3)

A. Statement - 1 is true, Statement - 2 is false

B. Statement - 1 is false. Statement - 2 is true

C. Statement-1 is true. Sratement-2 is true: Statement- 2 is a correct explanation for Statement-1

D. Statement-1 is true, Statement -2 is true Statement-2 is not a corret explanation for Statement-I

Answer: D

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38. If the angle between the line· x=(y−1)/2=(z-3)/λ and the plane· x+ 2y+ 3z= 4 is cos-1(√(5/14)) then λ equals :

A. $2/5$

B. $5/3$

C. $2/3$

D. $3/2$

Answer: C

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39. A line with positive direction cosines passes through the point $P(2, -1, 2)$ and makes equal angles with the coordinate axes. If the line meets the plane $2x + y + z = 9$ at the point Q, then the length PQ equals.

A. 1

B. $\sqrt{2}$

C. $\sqrt{3}$

D. 2

Answer: C

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40. Equation of a plane which passes through the point of intersection of lines $\frac{x-1}{3}=\frac{y-2}{1}=\frac{z-3}{2}$ and $\frac{x-3}{1}=\frac{y-1}{2}=\frac{z-2}{3}$ and at greatest distance from the origin is

A. 7x+2y+4z=54

B. 4x+3y+5z= 50

C. 3x+4y+5z=49

D. x+y+ z=12

Answer: B

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Practice Exercise

1. The value of k for which the lines $\frac{x+1}{-3}=\frac{y+5}{2k}=\frac{z-4}{2}$ and $\frac{x-3}{3k}=\frac{y-2}{1}=\frac{z+1}{7}$ are perpendicular is

A. 3

B. -1

C. 2

D. -2

Answer: C

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2. If the lines $\frac{x-1}{2} = \frac{y-2}{a} = \frac{z-3}{4}$ and $\frac{x+1}{b} = \frac{y+2}{1} = \frac{z-5}{2}$ are parallel then then a+b =

A. 3

B. 1

C. 5

D. 2

Answer: A

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3. The angles between the lines $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ and $x = \frac{y-7}{-3} = \frac{z+7}{2}$ are

A. $\frac{\pi}{3}, \frac{2\pi}{3}$

B. $\frac{\pi}{6}, \frac{5\pi}{6}$

C. $\frac{\pi}{4}, \frac{3\pi}{4}$

D. $\frac{\pi}{2}$

Answer: A

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4. The angle between the lines 2x = 3y = -z and

6x = -y= -4z is

A. 45°

B. 30°

C. 0°

D. 90°

Answer: D

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5. Angle between the lines

$\frac{x-2}{3} = \frac{y+1}{-2}$ = $z-2$ and

$\frac{x-1}{2} = \frac{y+\frac{3}{2}}{3} = \frac{z+5}{4}$ is

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{6}$

D. $\frac{\pi}{4}$

Answer: A

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6. The line x = 1, y = 2 is

A. parallel to the x-axis

B. parallel to the y-axis

C. parallel to the z-axis

D. parallel to the xy-plane

Answer: C

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7. The distance between the line

$\frac{x-2}{1}=\frac{y+2}{-1}=\frac{z-2}{4}$ and the plane

$\bar{r}.\left(\bar{i}+5\bar{j}+\bar{k}\right)=5$ is (units)

A. $\frac{10}{3\sqrt{3}}$

B. $\frac{10}{3}$

C. $\frac{10}{9}$

D. $\frac{5}{2}$

Answer: A

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8. The value of k such that $\frac{x-4}{1} = \frac{y-2}{1} = \frac{z-k}{2}$ lies in the plane 2x-4y+z+7=0 is

A. 7

B. -7

C. 4

D. no value

Answer: B

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9. If the line $\frac{x-3}{-4} = \frac{y-4}{-7} = \frac{z+3}{13}$ lies in the plane 5x-y+z =a then a =

A. 2

B. -3

C. 8

D. 9

Answer: C

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10. The line $\frac{x-2}{3} = \frac{y+1}{2} = \frac{z-1}{-1}$ intersect the curve $x^2 + y^2 = r^2, z = 0$ if r =

A. 26

B. $\sqrt{26}$

C. 6

D. $\sqrt{28}$

Answer: B

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11. Equation of the line 2x + z - 4 = 0 = 2y + z in symmetric form is

A. $\frac{x}{1} = \frac{y+2}{1} = \frac{z-4}{-2}$

B. $\frac{x-2}{1} = \frac{y+2}{1} = \frac{z-4}{2}$

C. $\frac{x-1}{2} = \frac{y+2}{1} = \frac{z-4}{2}$

D. x-2y+5z+3=0

Answer: A

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12. Equation of a line passing through (1,-2, 3) and parallel to the plane 2x+3y+z+5 = 0 is

A. $\frac{x-1}{-1}=\frac{y+2}{1}=\frac{z-3}{-1}$

B. $\frac{x-1}{2}=\frac{y+2}{3}=\frac{z-3}{1}$

C. $\frac{x+1}{-1}=\frac{y-2}{1}=\frac{z-3}{-1}$

D. none

Answer: A

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13. The line $\frac{x-1}{3}=\frac{y-3}{k}=\frac{z+1}{5}$ is perpendicular to the plane 6x-8y+10z-7=0 if k =

A. 4

B. -4

C. 3

D. 2

Answer: B

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14. The foot of the perpendicular from the point (1,2,3) to the line $\frac{x}{2} = \frac{y-1}{3} = \frac{z-1}{3}$ is

A. (1,5/2,5/2)

B. (1,9/4,11/4)

C. (1,3,2)

D. (3,1,2)

Answer: A

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15. The image of the point (1, 2, 3) in the line $\frac{x}{2} = \frac{y-1}{3} = \frac{z-1}{3}$ is

A. (1, 5/2, 5/2)

B. (1, 9/4, 11 /4)

C. (1, 3, 2)

D. (3, 1, 2)

Answer: C

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16. The point of intersection of the lines $\frac{x-4}{1}=\frac{y+3}{-4}=\frac{z+1}{4}$ and $\frac{x+1}{2}=\frac{y+1}{3}=\frac{z+10}{8}$ is

A. (5,7,6)

B. (5, -7, 6)

C. (5, 6, 7)

D. (-5, 6, 7)

Answer: B

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17. The shortest distance between the two lines $\frac{x-4}{1}=\frac{y+1}{2}=\frac{z}{-3}$ and $\frac{x-1}{2}=\frac{y-1}{4}=\frac{z-2}{-5}$

A. $\frac{2}{\sqrt{5}}$

B. $\frac{3}{\sqrt{5}}$

C. $\frac{6}{\sqrt{5}}$

D. $\frac{7}{\sqrt{5}}$

Answer: C

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18. The equation of a line through (-2, 3, 4) and parallel to the planes 2x+3y+4z=5 and 3x+4y+5z=6 are

A. $\frac{x-2}{1}=\frac{y+3}{3}=\frac{z+4}{-1}$

B. $\frac{x+2}{2}=\frac{y-3}{3}=\frac{z-4}{1}$

C. $\frac{x+2}{1}=\frac{y-3}{-2}=\frac{z-4}{1}$

D. $\frac{x+2}{-1}=\frac{y-3}{-2}=\frac{z-4}{1}$

Answer: C

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19. A plane which passes through the point (3,2,0) and the line $\frac{x-3}{1}=\frac{y-6}{5}=\frac{z-4}{4}$ is

A. x-y+z=1

B. x-y+z=5

C. x+2y-z=1

D. 2x-y+z=5

Answer: A

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20. Distance of the origin from the point of intersection of the line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and the plane 2x+y-z=2 is

A. $\sqrt{120}$

B. $\sqrt{83}$

C. $2\sqrt{19}$

D. $\sqrt{78}$

Answer: D

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21. If the straight lines $\frac{x-1}{k} = \frac{y-2}{2} = \frac{z-3}{3}$ and

$\frac{x-2}{3} = \frac{y-3}{K} = \frac{z-1}{2}$ intersect at a point then the interger k is equal to

A. -5

B. 5

C. 2

D. -2

Answer: A

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22. A line makes the same angle θ, with each of the x and z axis. If the angle β, which it makes with y-axis, is such that $\sin^2\beta = 3\sin^2\theta, \quad \text{then} \quad \cos^2\theta =$

A. $\frac{2}{3}$

B. $\frac{1}{5}$

C. $\frac{3}{5}$

D. $\frac{2}{5}$

Answer: C

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23. If a line makes an angle of $\pi/4$with the positive directions of each of x-axis and y-axis, then the angle that the line makes with the positive direction of the z-axis is

A. $\frac{\pi}{6}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{2}$

Answer: D

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24. The line passing through the points (5,1,a) and (3,b,1) cross the yz -plane at the point (0,17/2,-13/2) .Then

A. a =2,b=8

B. a=4,b=6

C. a=6,b=4

D. a=8,b=2

Answer: C

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25. A line AB in three-dimensional space makes angles $45^\circ \text{ and } 120^\circ$ with the positive x-axis and the positive y-axis respectively. If AB makes an acute angle θ with the positive z-axis, then θ equals

A. 45°

B. 60°

C. 75°

D. 30°

Answer: B

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26. The shortest distance between the skew lines $l_1 : \bar{r} = \bar{a}_1 + \lambda \bar{b}_1$ and $l_2 : \bar{r} = \bar{a}_2 + \mu \bar{b}_2$ is

A. $\dfrac{(\bar{a}_2 - \bar{a}_1).\, \bar{b}_1 \times \bar{b}_2}{\left|\bar{b}_1 \times \bar{b}_2\right|}$

B. $\dfrac{(\bar{a}_2 - \bar{a}_1).\, \bar{a}_2 \times \bar{b}_2}{\left|\bar{b}_1 \times \bar{b}_2\right|}$

C. $\frac{(\bar{a}_2 - \bar{b}_2).\bar{a}_1 \times \bar{b}_1}{|\bar{b}_1 \times \bar{b}_2|}$

D. $\frac{(\bar{a}_1 - \bar{b}_2).\bar{b}_1 \times \bar{a}_2}{|\bar{b}_1 \times \bar{a}_2|}$

Answer: A

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27. A line makes angles α, β, γ with the coordinate axes. If $\alpha + \beta = \pi/2$, then $(\cos\alpha + \cos\beta + \cos\gamma)^2$ is equal to

A. $1 + \sin 2\alpha$

B. $1 + \sin 2\alpha$

C. $1 - \sin 2\alpha$

D. $\sin 2\alpha$

Answer: A

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28. The lines $\bar{r} = \bar{i} - \bar{j} + \lambda\left(2\bar{i} + \bar{k}\right)$ and $= \left(2\bar{i} - \bar{j}\right) + \mu\left(\bar{i} + \bar{j} - \bar{k}\right)$ intersect for

A. $\lambda = 1, \mu = 1$

B. $\lambda = 2, \mu = 3$

C. all values of λ and μ

D. no value of λ and μ

Answer: D

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