Suggested Solution for 2023 HKDSE Mathematics(core) Multiple Choice Questions

1. C

$\frac{a+5b}{7a+2b} = \frac{1}{b+3}$

$(a + 5b)(b + 3) = 7a + 2b$

$ab + 5b^2 + 3a + 15b = 7a + 2b$

$5b^2 + 15b - 2b = 7a - 3a - ab$

$4a - ab = 5b^2 + 13b$

$a(4 - b) = 5b^2 + 13b$

$a = \frac{5b^2+13b}{4-b}$

2. C

$\frac{2}{5-4x} - \frac{1}{5+4x}$

$= \frac{2(5+4x)-(5-4x)}{(5-4x)(5+4x)}$

$= \frac{10+8x-5+4x}{25-16x^2}$

$= \frac{5+12x}{25-16x^2}$

3. A

$4^{n+2} \cdot 3^{2n+4}$

$= 2^{2(n+2)} \cdot 3^{2n+4}$

$= 2^{2n+4} \cdot 3^{2n+4}$

$= (2 \cdot 3)^{2n+4}$

$= 6^{2n+4}$

4. B

$2x^2 + xy - y^2 + 4x + 4y$

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

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

5. A

$(x + 2)(x + c) + 12 \equiv x(x + d) + 6c(x + 1)$

$x^2 + (c + 2)x + 2c + 12 \equiv x^2 + (6c + d)x + 6c$

By comparing the coefficients,

$6c = 2c + 12 \Rightarrow c = 3$

$3 + 2 = 6(3) + d$

$d = -13$

Alternatively

Substitute $x = 0$ on both sides,

$2c + 12 = 6c \Rightarrow c = 3$

Then, substitute $x = 1^{(*)}$ on both sides,

$(1 + 2)(1 + 3) + 12 = 1(1 + d) + 6(3)(1 + 1)$

$d = -13$

(*) Note that any convenient number e.g. $x = -1, -2$ or -3 may also give the answer.

6. D

$x - 3 < -5$ or $\frac{6-x}{4} < 2$

$x > -5 + 3$ or $6 - x < 8$

$x > -2$ or $x > -2$

$\therefore \quad x \neq -2$

7. C

The absolute error is $\frac{0.1}{2}$ i.e. 0.05.

$\therefore \quad 73.8 - 0.05 \leq y < 73.8 + 0.05$ i.e. $73.75 \leq y < 73.85$

8. D

$g(1 - 3\alpha)$

$= 13 - 5(1 - 3\alpha)^2$

$= 13 - 5(1 - 6\alpha + 9\alpha^2)$

$= 13 - 5 + 30\alpha - 45\alpha^2$

$= 8 + 30\alpha - 45\alpha^2$

9. A

By Factor theorem,

$h\left(\frac{3}{2}\right) = 0$

$a\left(\frac{3}{2}\right)^6 + 16\left(\frac{3}{2}\right)^3 + b = 0$ i.e. $b = -a\left(\frac{3}{2}\right)^6 - 16\left(\frac{3}{2}\right)^3 \ldots(1)$

By Factor theorem, the required remainder

$= a\left(-\frac{3}{2}\right)^6 + 16\left(-\frac{3}{2}\right)^3 + b$

$= a\left(-\frac{3}{2}\right)^6 + 16\left(-\frac{3}{2}\right)^3 - a\left(\frac{3}{2}\right)^6 - 16\left(\frac{3}{2}\right)^3$ [From(1)]

$= -108$

10. D

$y = 5 + (x - 3)^2$

$= x^2 - 6x + 14$

Substitute $x = 3$,

$y = (3)^2 - 6(3) + 14$

$= 5$

$\therefore$ The graph passes through the point (3, 5).

11. B

Let $c be the cost of the jacket.

$(1 + 60\%)c \times (1 - 25\%) = c + 104$

$c = 520$

12. D

$$\frac{\text{Area on the map}}{\text{Actual area}} = \left(\frac{1}{50000}\right)^2$$

$$\frac{\text{Area on the map}}{10} = \left(\frac{1}{50000}\right)^2$$

Area on the map $= 4 \times 10^{-9}$ km^2

$= 40$ cm^2

13. B

Let $z = kx^2y^{\frac{1}{3}}$ where k is a constant.

Then, $36 = k(12)^2(64)^{\frac{1}{3}}$

$k = \frac{1}{16}$

$\therefore \quad z = \frac{1}{16}x^2y^{\frac{1}{3}}$

When $x = 16$ and $y = 729$,

$z = \frac{1}{16}(16)^2(729)^{\frac{1}{3}}$

$= 144$

Alternatively

$36 = k(12)^2(64)^{\frac{1}{3}}$ … (1)

$z = k(16)^2(729)^{\frac{1}{3}}$ … (2)

(2) ÷ (1),

$$\frac{z}{36} = \frac{k(16)^2(729)^{\frac{1}{3}}}{k(12)^2(64)^{\frac{1}{3}}}$$

$z = 144$

14. B

$a_8 = a_7 + a_6$

$60 = a_7 + 23$

$a_7 = 37$

Note that $a_n = a_{n+2} - a_{n+1}$

Then,

$a_5 = a_7 - a_6 = 37 - 23 = 14$

$a_4 = a_6 - a_5 = 23 - 14 = 9$

$a_3 = a_5 - a_4 = 14 - 9 = 5$

15. A

Let r cm and h cm be the base radius and the height of the circular cylinder respectively.

$\pi r^2 h = 60^3$ … (1)

$2\pi rh = 6 \times 60^2$ … (2)

$\frac{(1)}{(2)}$,

$\frac{\pi r^2 h}{2\pi rh} = \frac{60^3}{6\times 60^2}$

$r = 20$

16. D

Note that G is the centre of the circle $BEDF$.

Let O be the centre of the circle $ABCD$.

Note that the radius of the circle $ABCD = \frac{AC}{2} = \frac{AG+CG}{2} = \frac{30+10}{2}$ = 20 cm

i.e. $OA = OB = OC = OD = 20$ cm

Let r cm be the radius of the circle $BEDF$.

Note that $DG \perp AF$.

By Pythagoras' theorem,

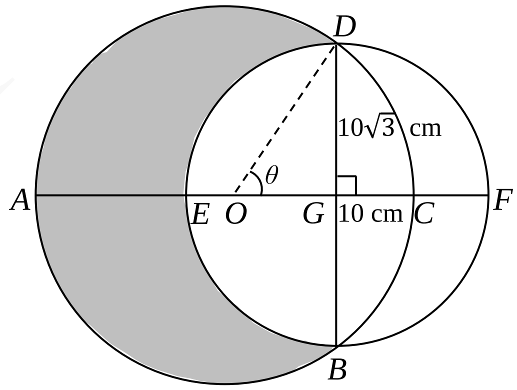
$OD^2 = DG^2 + OG^2$

$20^2 = r^2 + (OC - CG)^2$

$20^2 = r^2 + (20 - 10)^2$

$r = 10\sqrt{3}$

Let $\angle DOG = \theta$.



$\sin\theta = \frac{DG}{DE} = \frac{10\sqrt{3}}{20}$

$\theta = 60^\circ$

By symmetry, $\angle DOB = 2\theta = 120^\circ$

Area of sector $OBCD = \pi(20)^2 \times \frac{120^o}{360^o} = \frac{400\pi}{3}$ cm^2

Area of $\Delta DOB = \frac{1}{2} \times OG \times DB = \frac{1}{2} \times 10 \times (2 \times 10\sqrt{3}) = 100\sqrt{3}$ cm^2

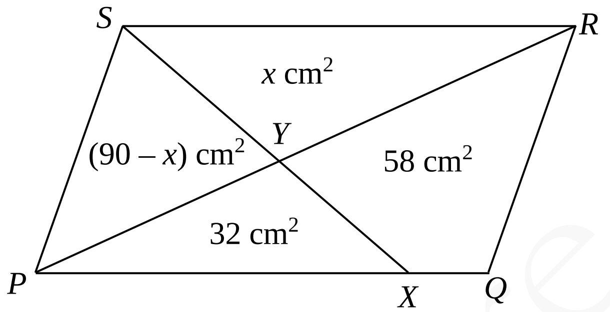
Area of segment $BCDG$ = area of sector $OBCD$ – area of $\Delta DOB = (\frac{400\pi}{3} - 100\sqrt{3})$ cm^2

Area of the shaded region = area of the circle $ABCD$ – area of semi-circle DEB – area of segment $BCDG$

$= \pi(20)^2 - \frac{1}{2} \times \pi(10\sqrt{3})^2 - (\frac{400\pi}{3} - 100\sqrt{3})$

= 540 cm^2 (correct to the nearest cm^2)

17. B



Let the area of ΔRSY be x cm^2.

Note that the area of $\Delta RSP = 32 + 58 = 90$ cm^2.

∴ Area of $\Delta PSY = (90 - x)$ cm^2

Note that $\Delta RSY \sim \Delta PXY$.

∴ $RY : PY = SY : XY$

∵ ΔPSY and ΔRSY have the same height.

∴ Area of ΔRSY : area of $\Delta PSY = RY : PY$

∵ ΔSPY and ΔXPY have the same height.

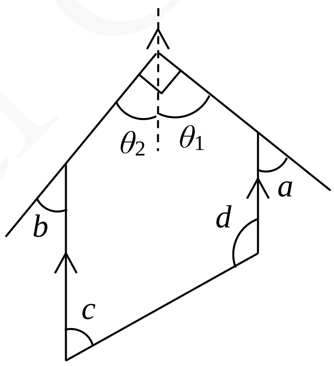
∴ Area of ΔSPY : area of $\Delta XPY = SY : XY$

∴ Area of ΔRSY : area of ΔPSY = Area of ΔSPY : area of ΔXPY [∵ $RY : PY = SY : XY$]

$x : (90 - x) = (90 - x) : 32$

Solving, $x = 50$ or 162(rejected)

18. A



Draw a line as shown.

$\theta_1 = a$ (alt. ∠s, //lines)

$\theta_2 = b$ (alt. ∠s, //lines)

$\theta_1 + \theta_2 = 90^\circ$

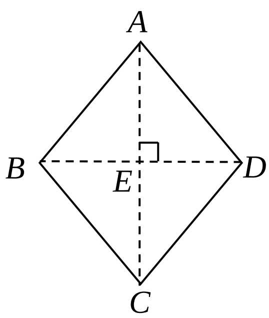
i.e. $a + b = 90^\circ$

∴ I is true.

$c + d = 180^\circ$ (int. ∠s, //lines)

∴ II is true.

19. C



Note that $AC \perp BD$, $AE = CE$ and $BE = DE$. (properties of rhombus)

$\frac{AE}{AC} = \frac{BE}{BD} = \frac{1}{2}$

∴ II is true.

By Pythagoras' theorem,

$AE^2 + BE^2 = AB^2 = CD^2$

∴ III is true.

20. A

Note that $AB = AK$.

$\therefore \quad \angle ABK = \angle AKB$ (base $\angle$s, isos, Δ)

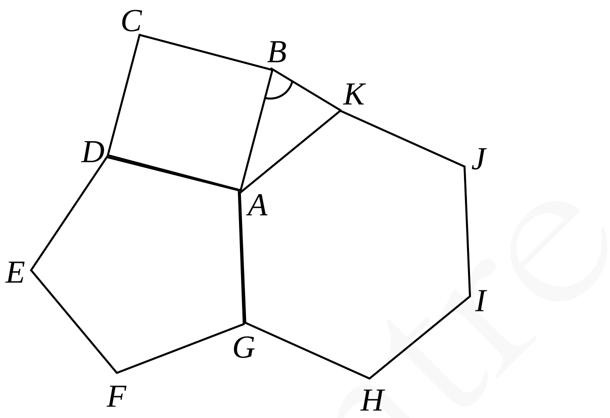
$\angle BAD = 90^o$ (properties of square)

$\angle DAG = \dfrac{180^o \times (5-2)}{5}$ ($\angle$ sum of polygon)

$= 108^o$

$\angle KAG = \dfrac{180^o \times (6-2)}{6}$ ($\angle$ sum of polygon)

$= 120^o$



$\angle BAK + \angle BAD + \angle DAG + \angle KAG = 360^o$ ($\angle$s at a pt.)

$\angle BAK + 90^o + 108^o + 120^o = 360^o$

$\angle BAK = 42^o$

$\angle ABK + \angle AKB + \angle BAK = 180^o$ ($\angle$ sum of Δ)

$2\angle ABK + 42^o = 180^o$

$\angle ABK = 69^o$

21. C

Let $\angle SPT = \theta$. Then, $\angle PST = 90^o - \theta$.

$\angle PTQ = \theta$ (alt. $\angle$s, SP // RQ)

$\angle UTQ + \angle PTQ + \angle PTS = 180^o$ (adj. $\angle$s on st. line)

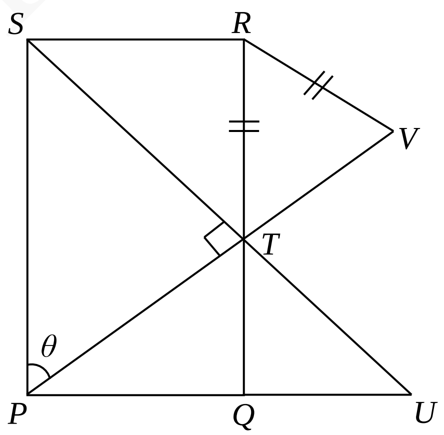
$\angle UTQ + \theta + 90^o = 180^o$

$\angle UTQ = 90^o - \theta$

$= \angle PST$

Also, $\angle PTS = \angle UQT = 90^o$

$\therefore \quad \Delta PST \sim \Delta UTQ$ (AAA)



22. B

Let $\angle TSU = x$. Then, $\angle TUS = \angle TSU = x$ (base $\angle$s, isos. Δ)

$\angle TRU = \angle TSU = x$ ($\angle$s in the same segment)

$\angle TRS = \angle TUS = x$ ($\angle$s in the same segment)

$\therefore \quad \angle WRS = 2x$

$\angle RSU = \angle RVU + \angle TUS$ (ext. $\angle$ of Δ)

$= 48^o + x$

$\angle WRS + \angle RWS + \angle RSW = 180^o$ ($\angle$ sum of Δ)

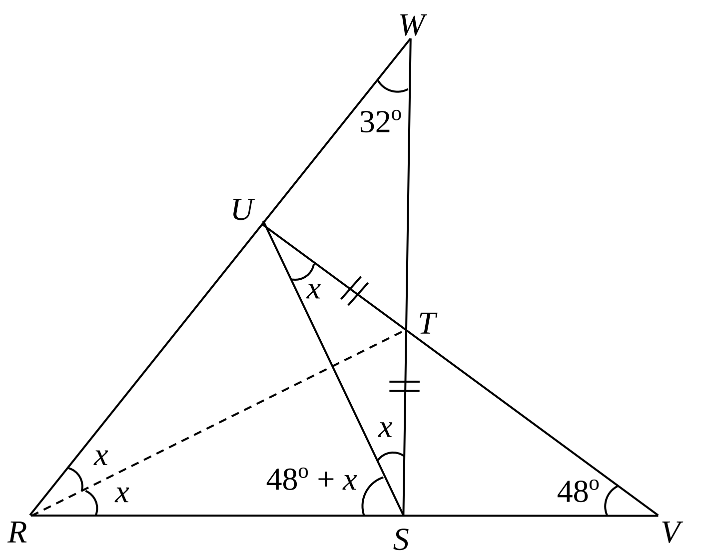
$2x + 32^o + (48^o + x + x) = 180^o$

➔ $\quad x = 25^o$

$\therefore \quad \angle RSU = 48^o + x$

$= 48^o + 25^o$

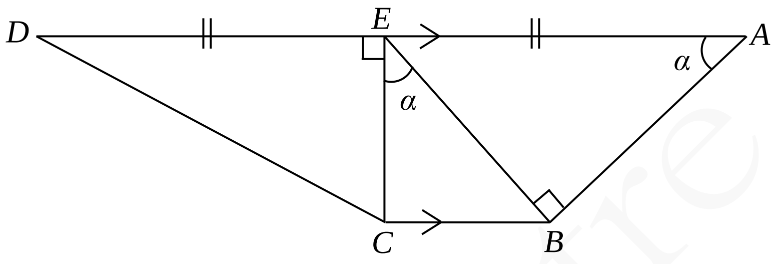
$= 73^o$



23. D

Note that $AE = DE$ and $\angle BEC = \alpha$.

$\frac{CE}{BE} = \cos\alpha$ i.e. $CE = BE\cos\alpha$ … (1)



$\frac{BE}{AE} = \sin\alpha$

$BE = AE\sin\alpha$

$= DE\sin\alpha$ … (2)

Combining (1) and (2),

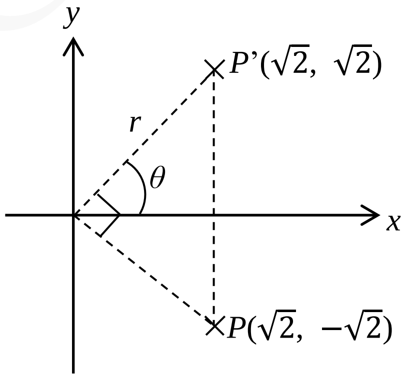
$CE = DE\sin\alpha\cos\alpha$

i.e. $\frac{CE}{DE} = \sin\alpha\cos\alpha$

24. C

After anticlockwise rotation, the coordinates of the image of P(P’) are $(\sqrt{2},\ \sqrt{2})$.

Refer to the figure on the right.



$\tan\theta = \frac{\sqrt{2}}{\sqrt{2}} = 1$

➔ $\theta = 45^\circ$

$r = \sqrt{(\sqrt{2})^2 + (\sqrt{2})^2}$

$= 2$

∴ The required polar coordinates are $(2, 45^\circ)$.

25. A

Rewrite the equations of the two straight lines in slope-intercept form.

$y = -\frac{2}{a+3}x + \frac{5}{a+3}$

$y = \frac{a}{4}x + \frac{1}{4}$

∵ They are perpendicular to each other

∴ $-\frac{2}{a+3} \times \frac{a}{4} = -1$

$a = -6$

26. B

Rewrite the equations of ℓ and L in slope-intercept form.

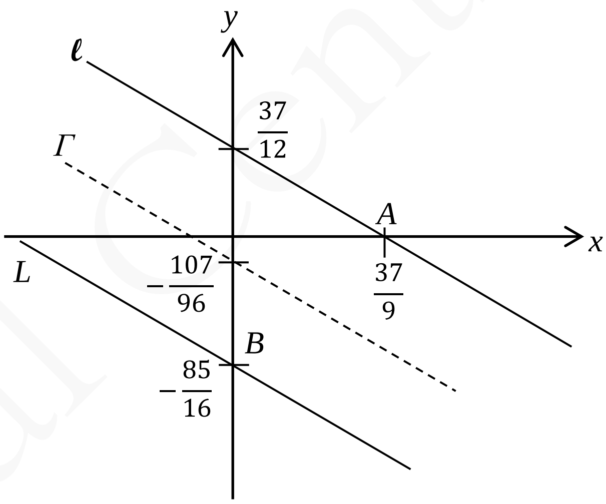
ℓ: $y = -\frac{3}{4}x + \frac{37}{12}$

L: $y = -\frac{3}{4}x - \frac{85}{16}$

$\therefore$ ℓ // L and the y-intercepts of ℓ and L are $\frac{37}{12}$ and $-\frac{85}{16}$ respectively.

The locus of Γ must be a straight line running between ℓ and L and parallel to both of them.

$\therefore$ I is true.



The y-intercept of $\Gamma = \frac{\frac{37}{12}+(-\frac{85}{16})}{2} = -\frac{107}{96}$

$\therefore$ The equation of Γ is $y = -\frac{3}{4}x - \frac{107}{96}$.

For ℓ, put $y = 0$,

$9x + 12(0) - 37 = 0$

$x = \frac{37}{9}$ i.e. The x-intercept of ℓ is $\frac{37}{9}$.

$\therefore$ $A = (\frac{37}{9}, 0)$ and $B = (0, -\frac{85}{16})$.

$m_{AB} = \frac{-\frac{85}{16}-0}{0-\frac{37}{9}} = \frac{765}{592}$

$m_{AB} \times m_\Gamma$

$= \frac{765}{592} \times -\frac{3}{4}$

$= -\frac{2295}{2368}$

$\neq 1$

$\therefore$ II is NOT true.

The mid-pt. of $AB = \left(\frac{\frac{37}{9}+0}{2}, \frac{0+(-\frac{85}{16})}{2}\right)$ i.e. $(\frac{37}{18}, -\frac{85}{32})$

Substitute $x = \frac{37}{18}$ into the R.H.S. of the equation of Γ,

$-\frac{3}{4}(\frac{37}{18}) - \frac{107}{96} = -\frac{85}{32}$

$\therefore$ Γ passes through the mid-pt. of AB.

$\therefore$ III is true.

27. C

Note that $C_2 : x^2 + y^2 - x - 8y - \frac{17}{2} = 0$

$G_1 = \left(\frac{-7}{2}, \frac{-(-4)}{2}\right) = (\frac{-7}{2}, 2)$

$G_2 = \left(\frac{-(-1)}{2}, \frac{-(-8)}{2}\right) = (\frac{1}{2}, 4)$

$OG_1 = \sqrt{\left(-\frac{7}{2} - 0\right)^2 + (2-0)^2} = \frac{\sqrt{65}}{2}$

$OG_2 = \sqrt{\left(\frac{1}{2} - 0\right)^2 + (4-0)^2} = \frac{\sqrt{65}}{2}$

$G_1G_2 = \sqrt{\left(-\frac{7}{2} - \frac{1}{2}\right)^2 + (2-4)^2} = 2\sqrt{5}$

∴ I is NOT true.

Radius of C_2, $r_2 = \sqrt{\left(\frac{1}{2}\right)^2 + 4^2 - \left(-\frac{17}{2}\right)} = \frac{\sqrt{99}}{2}$ / $\frac{3\sqrt{11}}{2} > 2\sqrt{5}$

i.e. G_1 lies inside C_2.

Also, $\frac{\sqrt{99}}{2} > \frac{\sqrt{65}}{2}$

∴ O lies inside C_2.

∴ OG_1 must lie inside C_2.

∴ II is true.

Radius of C_1, $r_1 = \sqrt{\left(-\frac{7}{2}\right)^2 + 2^2 - 15} = \frac{\sqrt{5}}{2}$

$r_1 + r_2$

$= \frac{\sqrt{5}}{2} + \frac{\sqrt{99}}{2}$

$> 2\sqrt{5} = G_1G_2$

∴ C_1 and C_2 intersects at two distinct points.

∴ III is true.

28. D

Refer to the table on the right. The numbers circled are divisible by 4.

The required probability

$= \frac{9}{20}$

1st box (columns); 2nd box (rows)

	1	2	3	4	5
6	6	12	18	24	30
7	7	14	21	28	35
8	8	16	24	32	40
9	9	18	27	36	45

29. C

From the box-and-whisker diagram, the upper quartile of the distribution is 60.

30. A

The mean salary

$= \$\frac{31530\times14+21525\times56}{214+56}$

= $23 526

31. B

1011001011001011_2

$= 1\times2^{15}+1\times2^{13}+1\times2^{12}+1\times2^{9}+1\times2^{7}+1\times2^{6}+1\times2^{3}+1\times2^{1}+1\times2^{0}$

$= (2^3+2^1+1)\times2^{12}+(2^3+2^1+1)\times2^6+(8+2+1)$

$= 11\times2^{12}+11\times2^6+11$

32. D

Taking the largest degree from a, b and c, the L.C.M. is $a^4b^5c^2$.

33. A

Slope of the graph of the linear function $= \frac{5-0}{0-3} = -\frac{5}{3}$. Then, the equation of the linear function is

$\log_8 y = -\frac{5}{3}\log_4 x + 5$

$= \log_4 x^{-\frac{5}{3}} + \log_4 4^5$

$= \log_4 (4^5x^{-\frac{5}{3}})$

$\frac{\log y}{\log 8} = \frac{\log\left(4^5x^{-\frac{5}{3}}\right)}{\log 4}$ [using change of base formula]

$\frac{\log y}{3\log 2} = \frac{\log\left(4^5x^{-\frac{5}{3}}\right)}{2\log 2}$

$\log y = \log\left(4^5x^{-\frac{5}{3}}\right)^{\frac{3}{2}}$

$= \log\left(4^{\frac{3}{2}\times5}x^{-\frac{5}{2}}\right)$

$= \log\left(8^5x^{-\frac{5}{2}}\right)$

$\therefore\ y = 8^5x^{-\frac{5}{2}}$ ➔ $x^5y^2 = 8^{10}$

34. B

$\frac{i}{k-i} + \frac{2}{k+i}$

$= \frac{i(k+i)+2(k-i)}{(k-i)(k+i)}$

$= \frac{ki+i^2+2k-2i}{k^2-i^2}$

$= \frac{ki-1+2k-2i}{k^2+1}$

$= \frac{2k-1}{k^2+1} + \frac{k-2}{k^2+1}i$

$\therefore$ The real part = $\frac{2k-1}{k^2+1}$

35. D

$y = -f(3x)$

$= -[3(3x)^2 + 18m(3x) + 22m^2]$

$= -(27x^2 + 54mx + 22m^2)$

$= -27(x^2 + 2mx + m^2) + 5m^2$

$= -27(x + m)^2 + 5m^2$

$\therefore$ The vertex of the graph = $(-m, 5m^2)$

$\therefore$ I is NOT true and II is true.

The equation of the axis of symmetry of the graph is $x + m = 0$.

$\therefore$ III is true.

36. B

Let T(1) = a and the common difference = d. Then,

$a + 10d = 83$ … (1)

$(a + 24d) + (a + 29d) = 463$ i.e. $2a + 53d = 463$ … (2)

Solving (1) and (2),

$a = -7$ and $d = 9$

$\because$ $T(1) + T(2) + T(3) + \ldots + T(k) > 4 \times 10^5$

$\therefore$ $\frac{k}{2}[2(-7) + (k-1)(9)] > 4 \times 10^5$

$9k^2 - 23k - 8 \times 10^5 > 0$

$k < -296.8673574$(rejected) or $k > 299.4229129$

$\therefore$ The least value of k is 300.

37. D

$$\begin{cases} x + 3 = 0 \ \ldots (1) \\ 2x + 3y - 12 = 0 \ \ldots (2) \\ 5x - 3y + 12 = 0 \ \ldots (3) \end{cases}$$

Solving (1) and (2), the intersection of (1) and (2) is (–3, 6).

Similarly, the intersection of (1) and (3) is (–3, –1)

while that of (2) and (3) is (0, 4).

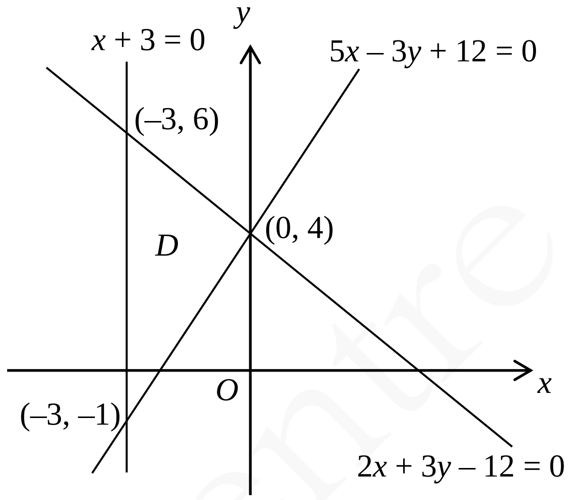
Let $P(x, y) = \beta x + 6y$

$P(-3, 6) = \beta(-3) + 6(6) \leq 24$ ➔ $\beta \geq 4$

$P(-3, -1) = \beta(-3) + 6(-1) \leq 24$ ➔ $\beta \geq -10$

$P(0, 4) = \beta(0) + 6(4) = 24$

∴ Combining the results, $\beta \geq 4$.



38. C

Join PR.

∵ $SP = SR$ (tangent properties)

∴ $\angle SPR = \angle SRP$ (base ∠s, isos. Δ)

$\angle SPR + \angle SRP + \angle PSR = 180^\circ$ (∠ sum of Δ)

$2\angle SPR + 34^\circ = 180^\circ$

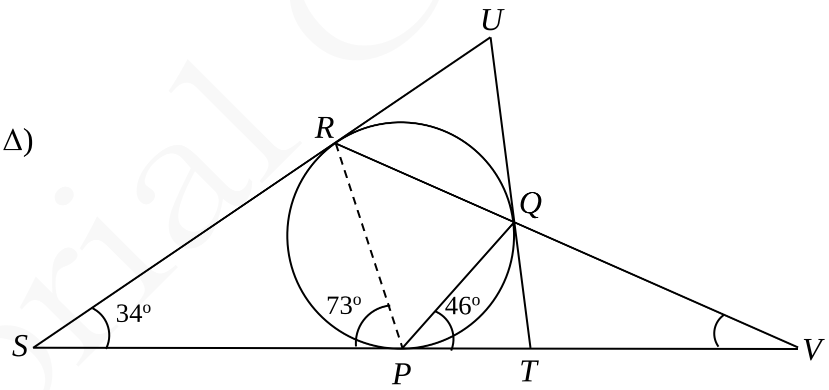
$\angle SPR = 73^\circ$

$\angle PQR = \angle SPR = 73^\circ$ (∠ in alt. segment)

$\angle PVQ + \angle QPT = \angle PQR$ (ext. ∠ of Δ)

$\angle PVQ + 46^\circ = 73^\circ$

$\angle PVQ = 27^\circ$



Alternatively

Let O be the centre of the circle.

Then, $\angle ORS = \angle OPS = 90^\circ$ (tangent ⊥ radius)

$\angle POR + \angle PSR + \angle ORS + \angle OPS = 360^\circ$ (∠ sum of polygon)

$\angle POR + 34^\circ + 90^\circ + 90^\circ = 360^\circ$

$\angle POR = 146^\circ$

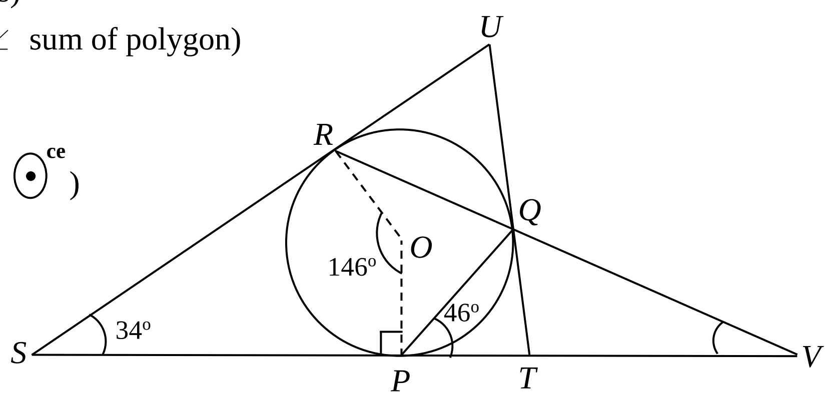
$2\angle PQR = \angle POR$ (∠ at centre twice ∠ at ⊙ce)

$\angle PQR = 73^\circ$

$\angle PVQ + \angle QPT = \angle PQR$ (ext. ∠ of Δ)

$\angle PVQ + 46^\circ = 73^\circ$

$\angle PVQ = 27^\circ$

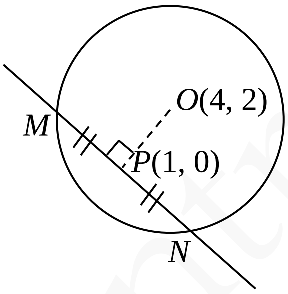


39. A

Let O be the centre of the circle. Then, the coordinates of O are $(-\frac{-8}{2},\ -\frac{-4}{2})$. i.e. (4, 2)

Let P = (1, 0). P is a point on the straight line $hx + ky = 6$.
Then, $h(1) + k(0) = 6$ i.e. $h = 6$

Slope of $MN = -\frac{h}{k} = -\frac{6}{k}$



∵ $OP \perp MN$ (line from centre to mid-pt. of chord ⊥ chord)

∴ $m_{OP} \times m_{MN} = -1$

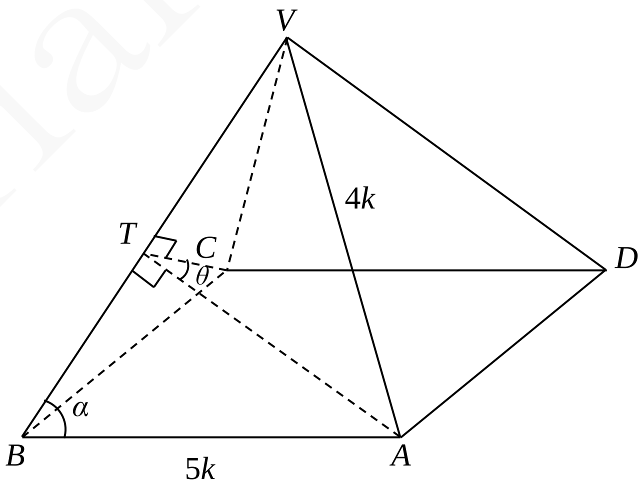
i.e. $\frac{2-0}{4-1} \times (-\frac{6}{k}) = -1$

∴ $k = 4$

40. A

Let T be the foot of perpendicular from A to BV. By symmetry, T is also the foot of perpendicular from C to BV. Then, $AT = CT$ and $\angle ATC = \theta$.
Let $\angle ABT = \angle CBT = \alpha$. Let $AB = 5k$ and $AV = BV = CV = DV = 4k$ where k is a constant.

By cosine formula,
$AV^2 = AB^2 + BV^2 - 2(AB)(BV)\cos\alpha$.
$(4k)^2 = (5k)^2 + (4k)^2 - 2(5k)(4k)\cos\alpha$



➔ $\cos\alpha = \frac{5}{8}$

$\sin^2\alpha + \cos^2\alpha = 1$

$\sin\alpha = \frac{\sqrt{39}}{8}$

$\frac{AT}{AB} = \sin\alpha = \frac{\sqrt{39}}{8}$

$AT = (5k)(\frac{\sqrt{39}}{8}) = \frac{5\sqrt{39}k}{8}$

By Pythagoras's Theorem,
$AC^2 = AB^2 + BC^2$
$= (5k)^2 + (5k)^2$
$= 50k^2$

By cosine formula,
$AC^2 = AT^2 + CT^2 - 2(AT)(CT)\cos\theta$

$50k^2 = \left(\frac{5\sqrt{39}k}{8}\right)^2 + \left(\frac{5\sqrt{39}k}{8}\right)^2 - 2\left(\frac{5\sqrt{39}k}{8}\right)\left(\frac{5\sqrt{39}k}{8}\right)\cos\theta$

$\cos\theta = -\frac{25}{39}$

41. C

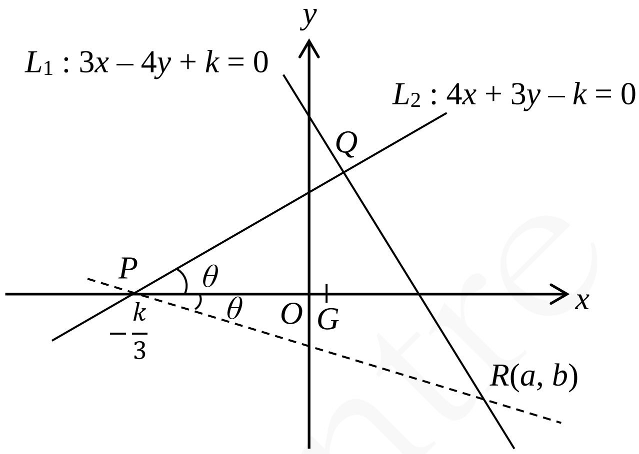
Let $R = (a, b)$. Let G be the in-centre of ΔPQR.

Then, $\angle QPG = \angle RPG = \theta$.

Substitute $y = 0$ into L_1,

$3x - 4(0) + k = 0$

➔ $x = -\frac{k}{3}$ i.e. The x-intercept of L_1 is $-\frac{k}{3}$.



∵ R is a point lying on L_2

∴ $4(a) + 3(b) - k = 0$

$b = -\frac{4a}{3} + \frac{k}{3}$

Rewrite L_1 as $y = \frac{3}{4}x + \frac{k}{4}$. i.e. $m_1 = \frac{3}{4}$

∴ $\tan\theta = \frac{3}{4}$

i.e. $\frac{-b}{a-\left(-\frac{k}{3}\right)} = \frac{3}{4}$

$\frac{-\left(-\frac{4a}{3}+\frac{k}{3}\right)}{a-\left(-\frac{k}{3}\right)} = \frac{3}{4}$

➔ $a = k$

42. B

Number of committees

= Number of ways of selecting 5 teachers from the group × number of ways selecting the chairperson

$= C_5^{15} \times C_1^5$

= 15 015

43. C

The required probability

= 1 – P("hit no time") – P("hit 1 time")

$= 1 - (1 - 0.6)^4 - C_1^4(0.6)(1 - 0.6)^3$

= 0.8208

44. D

Let μ and σ be the mean and standard deviation of the scores in the examination. Then,

$$\frac{46-\mu}{\sigma} = -3 \quad \ldots (1)$$

$$\frac{86-\mu}{\sigma} = 2 \quad \ldots (2)$$

Solving (1) and (2), $\mu = 70$ and $\sigma = 8$.

$$\therefore \quad \frac{x-70}{8} = 1$$

➔ $x = 78$

45. A

The mean of the group of numbers, $\bar{x} = \frac{1-9n+3-9n+4-9n+5-9n+7-9n}{5} = 4-9n$

$$u = \sqrt{\frac{[(1-9n)-(4-9n)]^2+[(3-9n)-(4-9n)]^2+[(4-9n)-(4-9n)]^2+[(5-9n)-(4-9n)]^2+[(7-9n)-(4-9n)]^2}{5}}$$

$= 2$

∴ I is true.

$v = 4-9n > 4$ for $n < 0$

∴ II may not be true.

$w = (7-9n)-(1-9n) = 6$

∴ III is not true.