DBE NOV 2025 PAPER 2

STATISTICS [20]

1.1 A ≃ 331 397,20 ; B ≃ –22 988,32

∴ **y = 331 397,20 – 22 988,32x** ✓

The eqn: **y = A + Bx**

1.2 Predicted selling price: Subst $x = 5$

R216 455,60 ✓

1.3 **r ≃ –0,95** ✓

The prediction is valid because the correlation coefficient is strong.

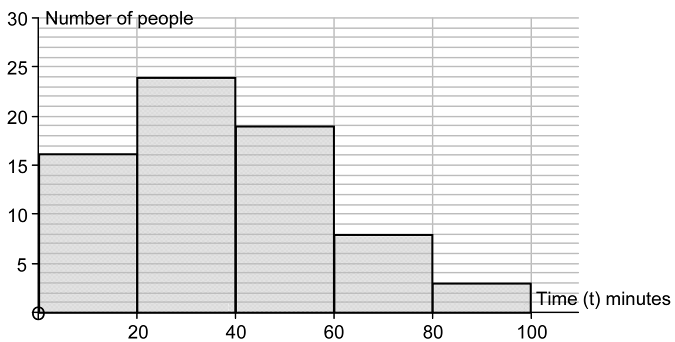
1.4 The estimated average yearly change = $\frac{dy}{dx}$ = –R22 988,32

∴ The estimated average yearly decrease = **R22 988,32** ✓

2.1.1 **70 people** ✓

2.1.2 67 – 40 = **27** ✓

2.1.3



2.1.4 The data is right (positively) skewed ✓

2.2 Total number of points (9 players) = 108

Total number of points scored by 8 players

= 11 + 14 + 19 + ... + 14

= 98

∴ The 9th player scores 10 points . . . *108 – 98*

The mean, $\bar{x}$ = 12 & the std deviation, σ ≃ 5,23

The number of players who score either less than $\bar{x} - \sigma$, 6,77, so 6 and less or more than $\bar{x} + \sigma$, 17,23, so 18 or more

∴ i.e. Those who scored 2, 19 and 20

∴ **3 Players** ✓

ANALYTICAL GEOMETRY [39]

3.1 $QR^2 = (12 + 4)^2 + (2 + 6)^2$

= 256 + 64

= 320

∴ QR = $\sqrt{320} = \sqrt{64 \times 5}$ = **$8\sqrt{5}$ units** ✓

3.2 $m_{QR} = \frac{2+6}{12+4} = \frac{8}{16} = \mathbf{\frac{1}{2}}$ ✓ . . . *= tan θ*

3.3 ∴ θ ≃ **26,57°** ✓

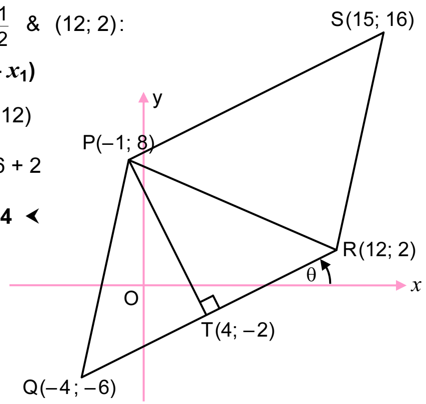
3.4 Subst. $m_{QR} = \frac{1}{2}$ & (12; 2):

$y - y_1 = m(x - x_1)$

∴ $y - 2 = \frac{1}{2}(x - 12)$

∴ $y = \frac{1}{2}x - 6 + 2$

∴ **$y = \frac{1}{2}x - 4$** ✓



3.5 By inspection: **S(15; 16)** ✓

3.6 Eqn of QR: $y = \frac{1}{2}x - 4$

Eqn of PT: m = –2 & pt (–1; 8)

∴ $y - 8 = -2(x + 1)$

∴ $y = -2x + 6$

At T: $\frac{1}{2}x - 4 = -2x + 6$

∴ $\frac{5}{2}x = 10$

$\left(\times \frac{2}{5}\right)$ ∴ $x = 4$

& $y = \frac{1}{2}(4) - 4 = -2$

∴ **T(4; –2)** ✓

Note: It so happens that T is the midpoint of QR! (But, it won't be correct to use the midpoint formula)

3.7 Area of ||^m PQRS = QR × PT

$PT^2 = (4 + 1)^2 + (-2 - 8)^2$

= 25 + 100

∴ PT = $\sqrt{125} = 5\sqrt{5}$ units

∴ Area of ||^m = $8\sqrt{5} \times 5\sqrt{5}$

= **200 units²** ✓

(OR: Find the area of ΔPQR, and double it.)

4.1 p = **–6** ✓

4.2 DE = 1 unit . . . *pt E(6; –1)*

∴ ME = q + 1

∴ MA = q + 1 . . . *equal radii*

In rt ∠^{d} ΔMDA:

$MA^2 = AD^2 + MD^2$ . . . *Thm of Pyth*

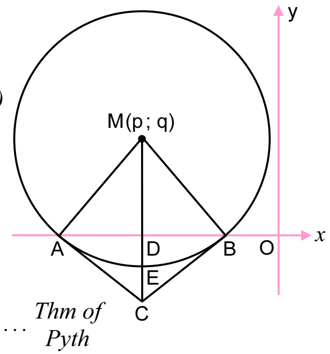
∴ $(q + 1)^2 = (q - 1)^2 + q^2$

∴ $q^2 + 2q + 1 = q^2 - 2q + 1 + q^2$

∴ $0 = q^2 - 4q$

∴ $q(q - 4) = 0$

∴ (q = 0 or) **q = 4** ✓



4.3 Centre (a; b) is (–6; 4)

& radius = q + 1 = 5

$\therefore$ Eqn of ⊙M: $(x + 6)^2 + (y - 4)^2$ = **25** ➤

4.4 The radius, r = 5 units

& M is 6 units from the y-axis . . . $p = x_E = -6$

$\therefore$ Currently, the distance = 1 unit

$\therefore$ **If translated, the minimum distance = 3 units** ➤

4.5 At A & B, y = 0

& Eqn. of ⊙M: $(x + 6)^2 + 16 = 25$ OR: $(x + 6)^2 = 9$

$\therefore (x + 6)^2 = 9$

$\therefore x + 6 = \pm 3$

$\therefore x = -3$ or -9 OR: 'On the sketch'

$\therefore$ **A(–9; 0) & B(–3; 0)** ➤

4.6 $m_{MB} = \frac{0-4}{-3+6}$ M(–6; 4) & B(–3; 0)

$= -\frac{4}{3}$

$\therefore m_{BC} = +\frac{3}{4}$ . . . *tang BC ⊥ rad MB*

& pt B(–3; 0):

$\therefore$ Eqn of BC: $y - 0 = \frac{3}{4}(x + 3)$

$\therefore$ $\mathbf{y = \frac{3}{4}x + \frac{9}{4}}$ ➤

4.7 $\mathbf{C\left(-6; -\frac{9}{4}\right)}$ ➤ . . . $x_E = -6$

& $y_C = \frac{3}{4}(-6) + \frac{9}{4} = -\frac{9}{2} + \frac{9}{4} = -\frac{9}{4}$

4.8 In ΔDBC: DB = 3 & DC = $\frac{9}{4}$ units

$\therefore \tan D\hat{C}B = \frac{3}{\frac{9}{4}}$

$= \frac{4}{3}$

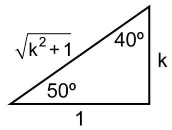
There are several possible methods.

$\therefore D\hat{C}B = 53{,}13^\circ$

$\therefore A\hat{C}B$ = **106,26°** ➤

TRIGONOMETRY [50]

5.1 $\tan 50^\circ = \frac{k}{1}$



5.1.1 $\cos 40^\circ = \mathbf{\frac{k}{\sqrt{k^2+1}}}$ ➤

5.1.2 $\frac{2\sin 25^\circ \cos 25^\circ}{-2 + 4\sin^2 25^\circ}$

$= \frac{\sin 2(25^\circ)}{-2(1 - 2\sin^2 25^\circ)}$ . . . *sin 2A = 2 sin A cos A*

$= \frac{\sin(50^\circ)}{-2\cos 2(25^\circ)}$ . . . *cos 2A = cos²A – sin²A = 1 – 2 sin²A*

$= -\frac{1}{2} \cdot \frac{\sin 50^\circ}{\cos 50^\circ}$

$= -\frac{1}{2}\tan 50^\circ = \mathbf{-\frac{1}{2}k}$ ➤

5.1.3 $\sin 10^\circ = \sin(50^\circ - 40^\circ)$

$= \sin 50^\circ \cos 40^\circ - \cos 50^\circ \sin 40^\circ$

$= \sin 50^\circ \sin 50^\circ - \cos 50^\circ \cos 50^\circ$

$= \sin^2 50^\circ - \cos^2 50^\circ$

$= \left(\frac{k}{\sqrt{k^2+1}}\right)^2 - \left(\frac{1}{\sqrt{k^2+1}}\right)^2$

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

$= \mathbf{\frac{k^2-1}{k^2+1}}$ ➤

5.2.1 $\frac{\sin(540^\circ + x)\cdot\cos(90^\circ + x)}{\sin(-x)}$

$= \frac{\sin(180^\circ + x)\cdot(-\sin x)}{(-\sin x)}$

$= \mathbf{-\sin x}$ ➤

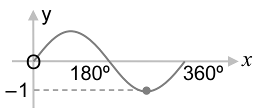
5.2.2 Consider when $\sqrt{-\sin x}$ will be real (See 5.2.1):

When $0 < -\sin x \leq 1$ $-\sin x \neq 0$ because it is in the denominator

$\times(-1)$ $\therefore 0 > \sin x \geq -1$

i.e. $-1 \leq \sin x < 0$

$\therefore$ **180° < x < 360°** ➤



6.1 **LHS**

$= [\tan(180^\circ - x)](1 - \cos^2 x) + \cos^2 x = \frac{(\sin x - \cos x)(1 + \sin x \cdot \cos x)}{-\cos x}$

$= (-\tan x)(\sin^2 x) + \cos^2 x$

$= -\frac{\sin x}{\cos x}(\sin^2 x) + \cos^2 x$

$= \frac{-\sin^3 x + \cos^3 x}{\cos x}$

$= \frac{-(\sin^3 x - \cos^3 x)}{\cos x}$

$= \frac{(\sin x - \cos x)(\sin^2 x + \sin x \cos x + \cos^2 x)}{-\cos x}$

$= \frac{(\sin x - \cos x)(1 + \sin x \cos x)}{-\cos x}$

= **RHS** ➤

6.2 $\cos^2 x - \sin^2 x = \frac{1}{2}\sin 2x - \cos^2 x$ . . . *= d, the common difference*

$\therefore 2\cos^2 x - \sin^2 x = \frac{1}{2}(2\sin x \cos x)$

$\therefore 2\cos^2 x - \sin^2 x = \sin x \cos x$

$\therefore 2\cos^2 x - \sin x \cos x - \sin^2 x = 0$

$\therefore (2\cos x + \sin x)(\cos x - \sin x) = 0$

$\therefore 2\cos x = -\sin x$ or $\cos x = \sin x$

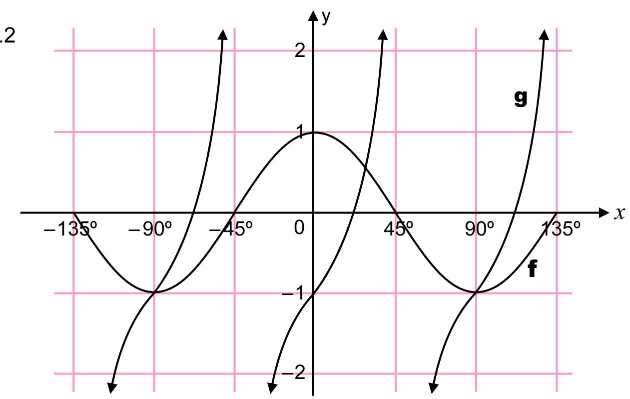
$(\div \cos x)$ $\therefore 2 = -\tan x$ But the constant difference = 0

$\therefore \tan x = -2$ $\therefore$ not applicable

$\therefore$ $\mathbf{x = 116{,}57^\circ + n(180^\circ), n \in \mathbb{Z}}$ ➤

7.1 **180°** ➤

7.2



7.3 $f(x) = \cos 2x$

$\therefore h(x) = \cos 2(x + 45°)$

$\therefore h(x) = \cos(2x + 90°)$

$\therefore$ **$h(x) = -\sin 2x$** ✓

7.4 **$y \in [-1; 1]$ or $-1 \leq y \leq 1$** ✓

7.5 $(1 - \tan 2x)(\cos 2x) \geq 0$

$\therefore (\tan 2x - 1)(\cos 2x) \leq 0$

$\therefore g(x).f(x) \leq 0$

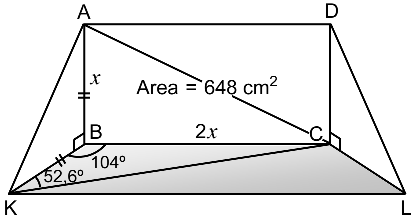
$\therefore$ **$0° \leq x \leq 22\frac{1}{2}°$ or $112{,}5° \leq x \leq 135°$** ✓

8.1 Let $AB = x$ cm; then $BC = 2x$ cm

Area of ABCD $= x \times 2x = 648$ cm^2 **$A = b \times \ell$**

$\therefore x^2 = 324$ cm^2

$\therefore$ **$AB = x = 18$ cm** ✓



8.2 In ΔABC: $AC^2 = 18^2 + 36^2 = 1\,620$ . . . *(Pyth)*

$\therefore$ **AC $\simeq$ 40,25 cm** ✓

8.3 In ΔBKC: $\frac{KC}{\sin 104°} = \frac{36}{\sin 52{,}6°}$

$\therefore KC = \frac{36 \sin 104°}{\sin 52{,}6°}$

$\simeq$ **43,97 cm** ✓

8.4 In rt $\angle^d$ ΔABK: $AK^2 = AB^2 + BK^2$ . . . *(Pyth)*

$= 18^2 + 18^2$ . . . *BK = AB = 18*

$= 648$

$\therefore$ In ΔAKC: $KC^2 = AK^2 + AC^2 - 2AK\,AC \cos K\hat{A}C$

$\therefore 43{,}97^2 = 648 + 1\,620 - 2.\sqrt{648}\sqrt{1\,620} \cos K\hat{A}C$

$\therefore 2\sqrt{648 \times 1\,620} \cos K\hat{A}C = 334{,}6391\ldots$

$= 0{,}1633\ldots$

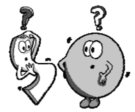
$\therefore$ **$K\hat{A}C = 80{,}60°$** ✓

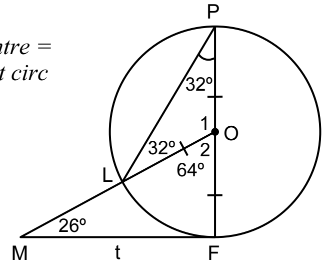
EUCLIDEAN GEOMETRY [41]

9.1 Theorem

9.2.1 $\hat{O}_2 = 2\hat{P}$ . . . *$\angle$ at centre = $2 \times \angle$ at circ*

$=$ **$64°$** ✓





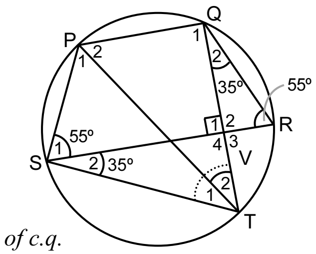
9.2.2 $O\hat{F}M = 90°$ . . . *diam $\perp$ tang*

$\therefore$ **$\hat{M} = 26°$** ✓ . . . *sum of $\angle^s$ of Δ*

10.1 $Q\hat{T}S = Q\hat{R}S$ . . . *$\widehat{QS}$ subtends*

$= 90° - 35°$ . . . *ext $\angle$ of Δ or sum of $\angle^s$ of Δ*

$=$ **$55°$** ✓



10.2 $\hat{S}_1 = \hat{R} = 55°$

& $P\hat{Q}R = \hat{Q}_1 + 35°$

$= 180° - \hat{S}_1$

$= 125°$ . . . *opp $\angle^s$ of c.q.*

$\therefore P\hat{Q}R + \hat{R} = 180°$

$\therefore$ **PQ || SR** ✓ . . . *co-int. $\angle^s$ suppl.*

10.3 $\hat{Q}_1 + \hat{V}_1 = 180°$ . . . *co-int. $\angle^s$; PQ || SR*

$\therefore \hat{Q}_1 = 90°$

$\therefore$ **PT is a diameter of the circle** ✓ . . . *conv. $\angle$ in semi-$\odot$*

11.1.1 In ΔCDA: $\frac{FD}{CF} = \frac{GA}{CG}$ . . . *prop thm; AD || GF*

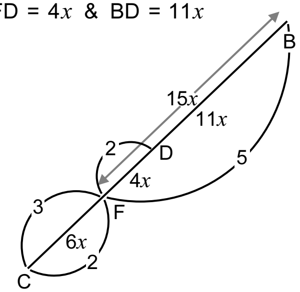
$=$ **$\frac{2}{3}$** ✓

11.1.2 ΔBEF: $\frac{BA}{EA} = \frac{BD}{FD}$ . . . *prop thm; AD || EF*

Let $CF = 6x$; then $FD = 4x$ & $BD = 11x$

$\therefore \frac{BA}{EA} = \frac{11x}{4x}$

$=$ **$\frac{11}{4}$** ✓



11.1.3 $\frac{\text{Area of } \Delta GCF}{\text{Area of } \Delta ACD} = \frac{\frac{1}{2} GC.CF \sin \hat{C}}{\frac{1}{2} AC.CD \sin \hat{C}}$

$= \frac{GC}{AC} . \frac{CF}{CD}$

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

$= \frac{9}{25}$

$\therefore \frac{\text{Area of } \Delta GCF}{\text{Area of GFDA}} = \frac{9}{25 - 9} =$ **$\frac{9}{16}$** ✓

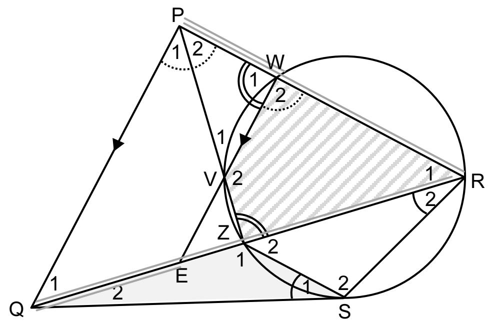
11.2.1

Note: Mark the 4 sides on the figure; it will be clear what to do . . .

In ΔRPQ, WE || PQ

$\therefore \dfrac{PR}{PW} = \dfrac{QR}{QE}$ . . . *prop thm*

$\therefore \mathbf{PR = \dfrac{PW.QR}{QE}}$ ◄



11.2.2 ΔPQZ ||| ΔRQP

➡ $\dfrac{PQ}{RQ} = \dfrac{QZ}{PQ} \left(= \dfrac{PZ}{PR} = \dfrac{PQ}{QR} \right)$ . . . *sides in proportion*

$\therefore \mathbf{PQ^2 = RQ.QZ}$ ◄

11.2.3 In Δ^s QSZ & QRS

(1) $\hat{Q}_2$ is common

(2) $\hat{S}_1 = \hat{R}_2$ . . . *tan chord thm*

$\therefore$ **ΔQSZ ||| ΔQRS** . . . ∠∠∠ ◄

11.2.4 From 11.2.2: $PQ^2 = RQ.QZ$ . . . ❶

& From 11.2.3: $\dfrac{QS}{QR} = \dfrac{QZ}{QS}$ . . . *prop sides*

$\therefore QS^2 = QR.QZ$ . . . ❷

❶ & ❷ $\therefore PQ^2 = QS^2$

$\therefore \mathbf{PQ = QS}$ ◄

11.2.5 From 11.2.1: $\dfrac{PW.QR}{QE} = PR$

$\therefore PW = \dfrac{QE.PR}{QR}$ . . . ❶

From 11.2.2: $\dfrac{PR}{QR} = \dfrac{PZ}{PQ}$ . . . ❷

❷ in ❶: $\therefore PW = \dfrac{QE.PZ}{PQ}$

From 11.2.4: $PQ^2 = QS^2 = QR.QZ$

$\therefore PQ = \sqrt{QR.QZ}$

$\therefore \mathbf{PW = \dfrac{QE.PZ}{\sqrt{QR.QZ}}}$ ◄