NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2021

MATHEMATICS: PAPER II

MARKING GUIDELINES

Time: 3 hours | 150 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

SECTION A

QUESTION 1

(a) $m_{\text{OB}} = \dfrac{3}{5}$

(b) $m_{\text{EC}} = -\dfrac{5}{3}$

$(-1) = -\dfrac{5}{3}(3) + c$

$c = 4$

$y = -\dfrac{5}{3}x + 4$

E(0; 4)

(c) $\text{EB} = \sqrt{(4-3)^2 + (0-5)^2}$

$\text{EB} = \sqrt{26}$ or 5,1

(d) $-\dfrac{5}{3}x + 4 = \dfrac{3}{5}x$

$x = \dfrac{30}{17}$

$y = \dfrac{3}{5}\left(\dfrac{30}{17}\right)$

$y = \dfrac{18}{17}$

(e) (1) $\text{Area } \Delta\text{EFC} = \dfrac{1}{2} \times 5 \times 3 = 7{,}5 \text{ units}^2$

(2) $\text{Area OGCF} = 7{,}5 - \dfrac{1}{2} \times 4 \times \dfrac{30}{17}$

Area OGCF = 4 units^2

QUESTION 2

(a) Coordinates of A(3; 2)

x value of E is 3 + 2 = 5

E(5; 2)

(b) $x^2 - 16x + 64 + y^2 - 2y + 1 + 63 = +65$

$(x-8)^2 + (y-1)^2 = 2$

B(8; 1)

(c) Radius of $\sqrt{2}$

G(5; 0)

GB = $\sqrt{10}$

$\text{G}\hat{\text{F}}\text{B} = 90^\circ$ Tangent perpendicular to radius

FG = $\sqrt{8}$ units or $2\sqrt{2}$ units

QUESTION 3

(a) $\cos x = \frac{4}{5}$ method

$x = 4$

$y = -3$

$r = 5$

$3 \sin 2x = 6 \sin x \cos x$

$= 6 \times \frac{-3}{5} \times \frac{4}{5}$

$= \frac{-72}{25}$

(b) $7 \tan 2x = 1$

$\tan 2x = \frac{1}{7}$

Reference angle: 8,1

$2x = 8{,}1° + k.\ 180°$

$x = 4{,}1° + k.\ 90°$

(c) (1) $\frac{\cos 2\theta + 1}{\cos \theta} + 2 \tan \theta . \sin \theta$

$= \frac{2\cos^2 \theta - 1 + 1}{\cos \theta} + \frac{2\sin^2 \theta}{\cos \theta}$

$= \frac{2\cos^2 \theta + 2\sin^2 \theta}{\cos \theta}$

$= \frac{2}{\cos \theta}$

Therefore A = 2

(2) $\cos \theta = 0$ ALT: where $\tan \theta$ is undefined

$\theta = 90° + k.180° \quad k \in Z$ OR

$\theta = 90° + k.360°$ or $\theta = 270° + k.360°$

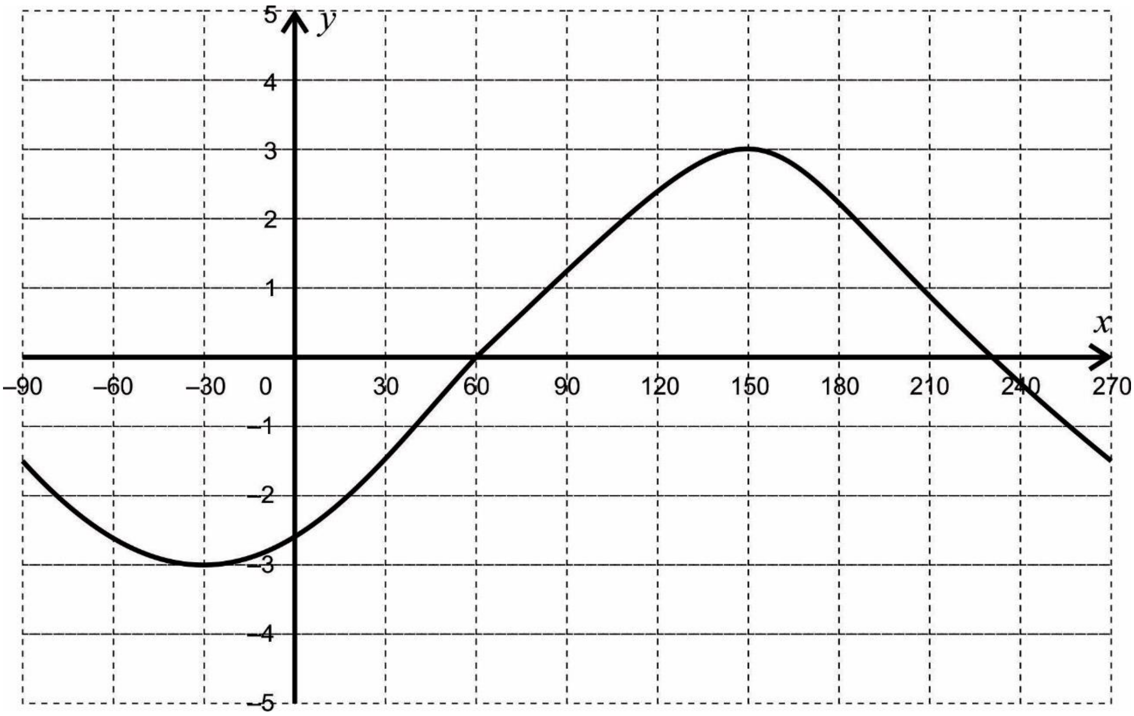
QUESTION 4

(a) Intercepts with axes

End-points

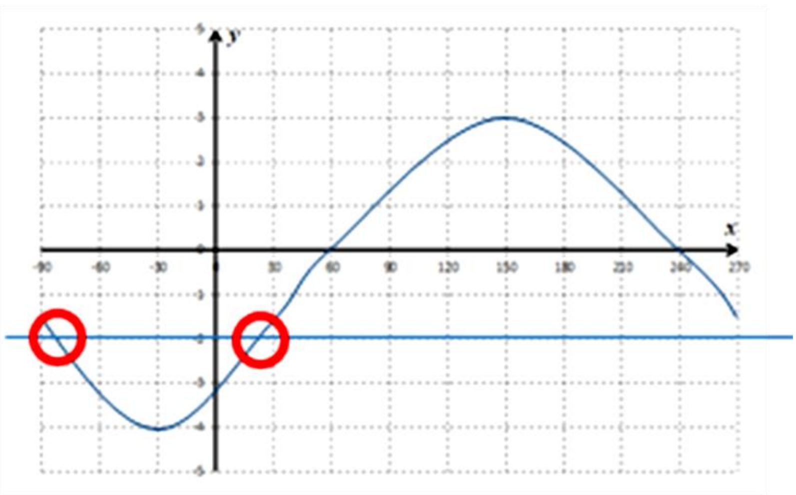
Turning points

Shape



(b) Line through –2

Points of intersection are indicated or correct values read off graph

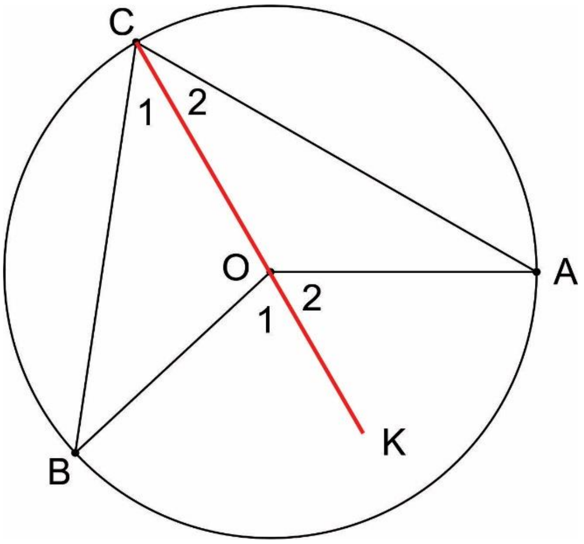


(c) $k < -3$ or $k > 3$

QUESTION 5

(a) RTP: $B\hat{O}A = 2 \times B\hat{C}A$

Construction CO to K or on the diagram



$\hat{O}_1 = \hat{C}_1 + \hat{B}$ Exterior angle of a triangle

$\hat{C}_1 = \hat{B}$ Radii; isos triangle

$\hat{O}_1 = 2\hat{C}_1$

Similarly

$\hat{O}_2 = 2\hat{C}_2$

$\hat{O}_1 + \hat{O}_2 = 2\left(\hat{C}_1 + \hat{C}_2\right)$

(b) $\hat{B} = 60^\circ$ Ext angle of cyclic quad

$\hat{A} = 120^\circ$ Angle at centre = 2 *x* angle at circumference

$\hat{C}_2 = 30^\circ$ (Radii; Isos triangle)

(c) $\hat{C} = 30^\circ$ Tan chord theorem

$\hat{E} = 60^\circ$ Equilateral triangle

$\hat{G} = 90^\circ$ Angles in a triangle

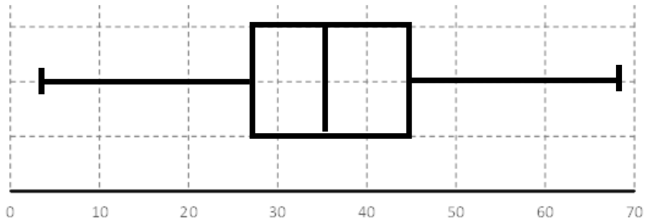
Therefore

CE is a diameter (Converse: Angles in a semi-circle)

QUESTION 6

(a) A = 430 B = 200 C = 800 D = 1 000

(b) (1) LV and HV
Quartile 1
Median
Quartile 3



(2) No, as the distance from Q1 to the median is very similar to the distance from Q2 to Q3. Diagram is symmetrical.

(3) The mean will get pulled to the left of the current mean.
Alt: Data will now be slightly skewed to the right or positively skewed.

SECTION B

QUESTION 7

(a) Stay the same the new height is the same as the mean.

(b) Decrease. The sum of the squares of the differences stays the same but it is divided by one more.

(c) The correlation coefficient will decrease. The point is well below the line of best fit.
Alt: Since no power from the grid is used this will have no influence on the correlation between the height of buildings and the power they use.

QUESTION 8

$\frac{x}{1,9} = \frac{5,4}{x}$ Prop theorem

$x^2 = 1,9 \times 5,4$

$x = 3,2$

$(3,2)^2 = 4^2 + 4^2 - 2(4)(4)\cos \hat{G}$

$\hat{G} = 47,2°$

QUESTION 9

(a) $D\hat{C}E = H\hat{E}I$ Alternate angles DC ll EH

CD = CE Tangents drawn from common point

Therefore $\hat{D} = D\hat{E}C$

EH = EI Radii

Therefore $\hat{H} = \hat{I}$

Hence

$\Delta DCE \parallel\mid \Delta HEI$ (A.A.A)

(b) $F\hat{G}E = 90^\circ$ Tangent perpendicular to radius

DG = GE Line from centre perpendicular to the chord

(c) $\frac{DC}{HE} = \frac{DE}{HI}$ (Prop. Theorem)

GE = EH Radii

DE = 2HE

$\frac{DC}{HE} = \frac{2HE}{HI}$

$2HE^2 = DC \times HI$

QUESTION 10

(a) Construction CD

$\hat{BCD} = 90^\circ$ Angle in semi-circle

$\hat{ECD} = x$ Angles in same segment

Therefore

$2x + 6^\circ = 90^\circ - x$

$3x = 84^\circ$

$x = 28^\circ$

(b) $\hat{KAJ} = 2x$ Angle at centre = 2 x angle at circumference

$\hat{AEG} = 55^\circ - x$ Tan chord theorem

$\hat{AGE} = 180^\circ - (2x + 55^\circ - x)$

$\hat{AGE} = 125^\circ - x$

But

$125^\circ - x + 55^\circ + x = 180^\circ$

Therefore

ABEG is a cyclic quad (Converse: Opp angles of cyclic quad are supplementary)

QUESTION 11

(a) $m_{\text{CD}} = \frac{4-3}{2-0} = \frac{1}{2}$

$(4) = -2(2) + c$

$c = 8$

$y = -2x + 8$

Midpoint of JK $\left(\frac{9}{2}; \frac{7}{2}\right)$

Gradient of perpendicular bisector is 1

$y = x - 1$

$x - 1 = -2x + 8$

$x = 3$

$y = 2$

(b) $m_{\text{AG}} = \frac{2-(-2)}{3-10}$ $\therefore$ $\tan\theta = \frac{4}{-7}$

Angle of inclination = 150,3°

$m_{\text{FG}} = \frac{1-(-2)}{8-10}$ $\therefore \tan\alpha = \frac{3}{-2}$

Angle of inclination = 123,7°

$\text{F}\hat{\text{G}}\text{A} = 26{,}6°$

Therefore

AFGO is a cyclic quadrilateral (Converse: Angles in same segment)

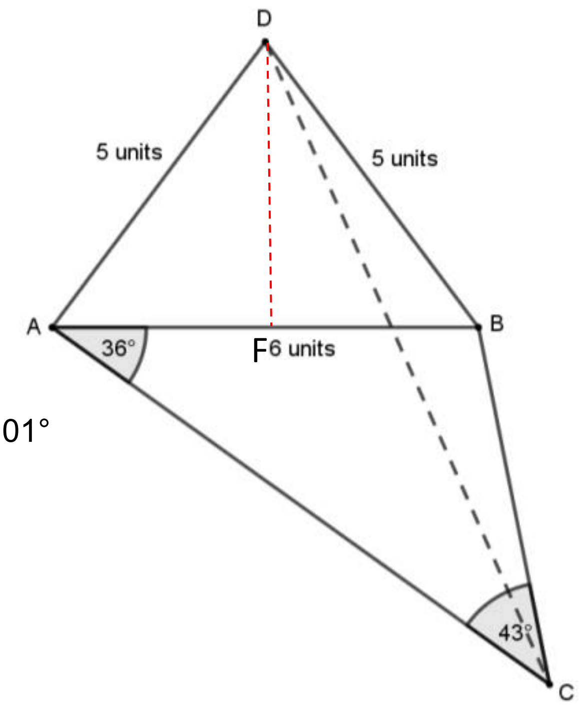
QUESTION 12

(a) ΔADB is an isosceles triangle so AB is bisected by the perpendicular from D.

Let perpendicular from D meet AB at F.

AF = FB = 3 units

FD = 4 units (Pythagoras)



(b) $\dfrac{BC}{\sin 36°} = \dfrac{6}{\sin 43°}$

BC = 5,17 units

$FC^2 = (3)^2 + (5{,}17)^2 - 2(3)(5{,}17)\cos 101°$

FC = 6,4535

DC = 7,59 units

(c) $\sin D\hat{B}A = \frac{4}{5}$

$D\hat{B}A = 53{,}1°$

$A\hat{B}C = 101°$

$DC^2 = (5)^2 + (5{,}2)^2 - 2(5)(5{,}2)\cos 154{,}1°$

DC = 9,9 units

Total: 150 marks