education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P3

NOVEMBER 2009

MEMORANDUM

MARKS: 100

This memorandum consists of 14 pages.

- Consistent Accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, mark the FIRST attempt.
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QUESTION 1

1.1	$T_1 = 1$; $T_2 = 1$; $T_n = T_{n-1} + T_{n-2}$ for $n \geq 3$ **OR** $T_{k+1} = T_k + T_{k-1}$ for $k \geq 2$ **OR** $T_{k+2} = T_{k+1} + T_k$ for $k \geq 1$	No penalty for leaving out $n \geq 3$ If they use any other recursive formula, follow it through.	✓ $T_1 = 1$, $T_2 = 1$ (both must be correct) ✓ $T_n = T_{n-1} + T_{n-2}$ (2)
1.2	1; 1; 2; 3; 5; 8; 13; 21; 34; 55; 89; 144; 233 144 + 233= 377 The next number in the sequence is 377.	Answer only: 3/3 If sequence is nonsense and comes out with 377, then max 2 / 3 If generate numbers and make mistake, then max 1 / 3	✓ 13 ; 21; 34; 55; 89 ; 144; 233 ✓ 144 ✓ 377 (3) **[5]**

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QUESTION 2

Provided the argument is logical, we need to take heed of it.

2.1	Number required = 240 learners	✓ answer (1)
2.2	No. The sample of 240 learners indicates that the views of a substantial number of learners will be taken into account (20% of the sample). However, whilst this is the case, it is of paramount importance that the sample must be representative of all the learners at the school; otherwise the results of this survey will be invalid. Therefore the sample size alone does not guarantee a valid result from a survey. **OR** Yes. Sampling method according to Nandi's method. Marks go for motivation of yes or no. If just answer yes or no, then 0 / 2	✓substantial number (20%) ✓ representative sample (or any other logical argument) (2)
2.3	Yes. In Nandi's case the sample will definitely have learners from different grades. Therefore the views of learners from grades across the school will be taken into account. However, in Sam's method, there is no guarantee that learners from all grades will be selected. The sample in Sam's case could be biased towards a particular grade or learners of the same age. If only answer Yes, 1 / 2	✓ yes ✓ answer (2)
2.4	In the composition of the sample no consideration was given to the number of boys and girls to be selected. Number of learners per grade. Extra curricular participation	✓ any ONE answer (1) **[6]**

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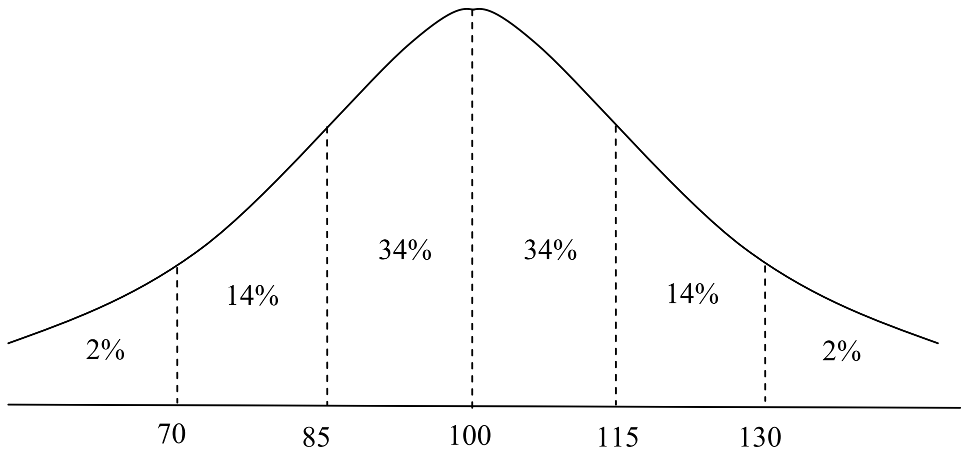
QUESTION 3



3.1	100 – 15 = 85 and 100 + 15 = 115. Therefore the interval between 85 and 115 lie within one standard deviation on either side of the mean. For the normal distribution, approximately 68% of the data lies within one standard deviation on either side of the mean. Accept the answers from 66% - 68% as a range You need to follow this through for the next questions.	✓one standard deviation ✓68% (2)
3.2	The score of 115 lies at one standard deviation distance to the right of the mean. Approximately 34% of the data lies in this interval, (one standard deviation). The score of 130 lies at two standard deviations to the right of the mean. Approximately 48% of the data lies in this interval (two standard deviations). Therefore, 14% of the scores should lie between 115 and 130. This translates to 14% of the members of this gym being classified as fit. If end up with 28% then 1 / 2 Accept range from 14% to 14,2%	✓ argument ✓ 14% (2)
3.3	The score of 130 lies at two standard deviations to the right of the mean. Approximately 48% of the members should fall into this interval. Therefore, 2% of the members lie in the region above the score of 130. 2% of 500 = 10 members would be above 130. If use 2,5% then the answer is 12,5. Accept 12 or 13 members as the answer. If candidate leaves answer as 12,5 members then max 1 / 2	✓ 2% or 2,5% ✓ 10 members (2) **[6]**

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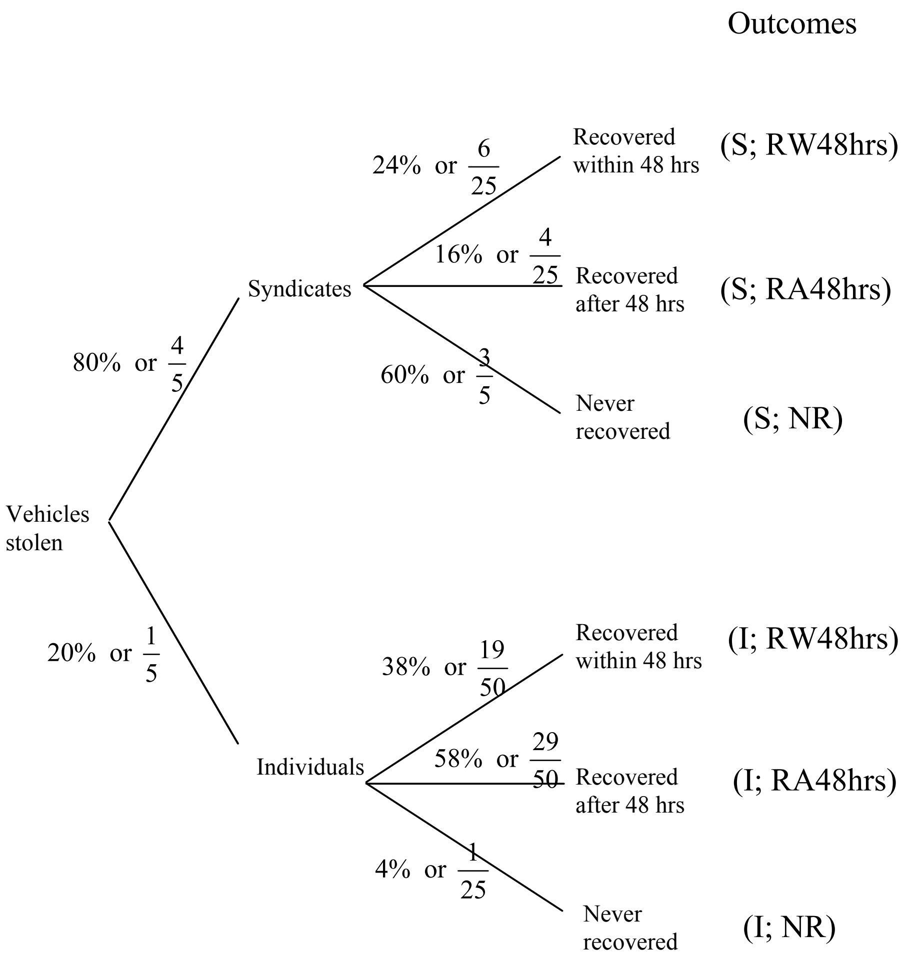
QUESTION 4

4.1



✓ First level
✓✓ Second level, Syndicates branch
Labels must be on (Recovered within 48 hrs; Recovered after 48 hrs; Never recovered)
✓✓ Second level, Individuals branch
Labels must be on (Recovered within 48 hrs; Recovered after 48 hrs; Never recovered)

> Penalty 1 for every mistake in the second level branch
>
> No values but tree diagram correct: 4 / 5

(5)

4.2 $P(S;\ RW48hrs) = \frac{80}{100} \times \frac{24}{100} = \frac{1\,920}{10\,000} = 0{,}192 = 19{,}2\%$ (0,19)

OR

$P(S;\ RW48hrs) = \frac{4}{5} \times \frac{6}{25} = \frac{24}{125}$

✓ probability
✓ answer

(2)

> Penalty 1 for giving correct to 1 decimal place
> Accept 0,19 and 0,192 or with more decimal places

4.3 P(stolen and not recovered) =

$\left(\frac{80}{100} \times \frac{60}{100}\right) + \left(\frac{20}{100} \times \frac{4}{100}\right) = 0{,}488 = 48{,}8\%$ (0,49)

OR

P(stolen and not recovered) =

$\left(\frac{4}{5} \times \frac{3}{5}\right) + \left(\frac{1}{5} \times \frac{1}{25}\right) = \frac{12}{25} + \frac{1}{125} = \frac{61}{125}$

✓ $\frac{12}{25}$ or 0,48
✓ $\frac{1}{125}$ or 0,08
✓ answer

(3)
[10]

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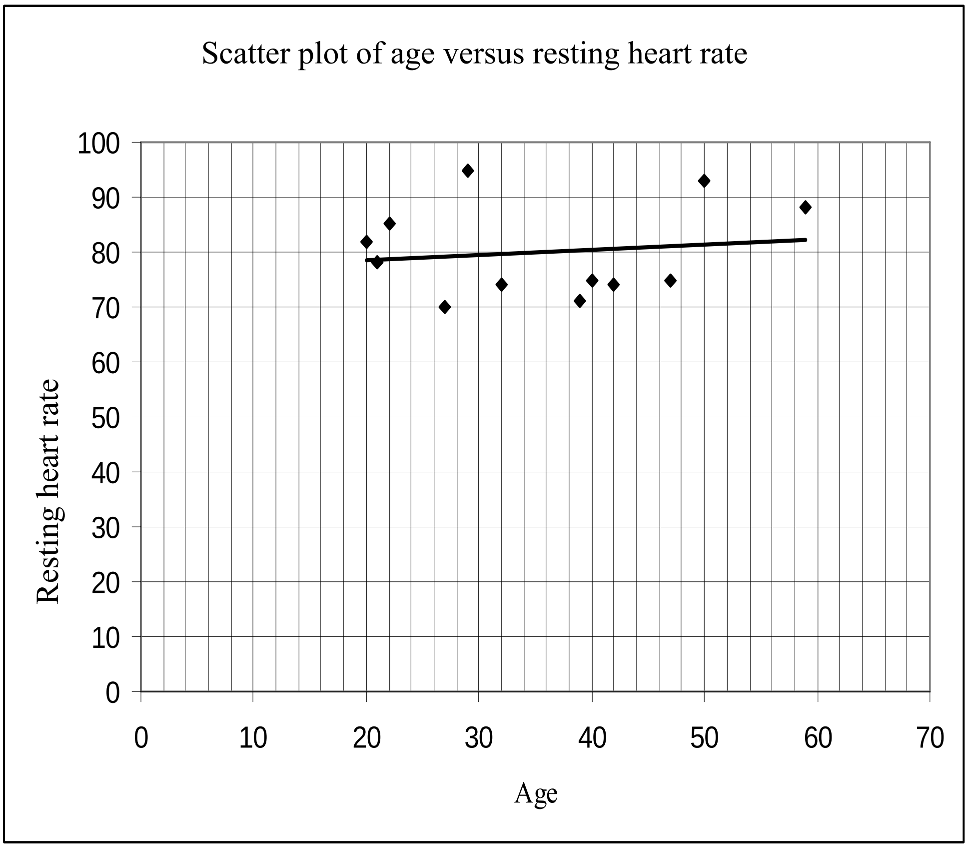
QUESTION 5

Age	20	21	22	27	29	32	39	40	42	47	50	59
Resting heart rate (beats per minute)	82	78	85	70	95	74	71	75	74	75	93	88

5.1 & 5.3		5.1 ✓ axes ✓✓ 12 plot points correctly (3) Initial value on the y-axis does not necessarily have to be zero. Only one mark for plotting 6 – 11 points correct Less than 6 correct, no marks for plotting 5.3 ✓ line ✓ gradient (close to zero) (2)
5.2	$a = 76{,}60$ (76,5956…) $b = 0{,}10$ (0,09544…) $\hat{y} = a + bx$ $= 76{,}60 + 0{,}10x$ Answer only: 4 / 4 No penalty for incorrect rounding	✓✓ a ✓ b ✓ equation (4)
5.4	$r = 0{,}14$	✓✓ $r = 0{,}14$ (2)
5.5	The value of r is positive and close to zero. This suggests that there is an insignificant relationship between age and resting heart rate.	✓ positive or not strong ✓ insignificant relationship (2)
5.6	No. The value of r being close to zero suggests that it is not reliable to predict the resting heart rate of a person by using age alone.	✓ No ✓ explanation (2) **[15]**

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QUESTION 6

6.1.1	P(students receiving financial aid) $= \frac{6\,101}{10\,730}$ $= 0{,}57$ Answer only: Full marks	$\frac{6\,101}{10\,730}$ ✓ numerator ✓ denominator (2)
6.1.2	P(postgraduate not receiving financial aid) $= \frac{731}{10370}$ $= 0{,}068$ Answer only: Full marks Also accept: $\frac{731}{2610}$	$\frac{731}{10370}$ ✓ denominator ✓ numerator (2)
6.1.3	P(undergraduate receiving financial aid) $= \frac{4\,222}{10370}$ $= 0{,}39$ Answer only: Full marks Also accept: $\frac{4\,222}{8\,120}$	$\frac{4\,222}{10370}$ ✓ numerator ✓ denominator (2)
6.2	Let UG be the event of being an undergraduate and RF be the event of receiving financial aid. P(UG and RF) $= \frac{4\,222}{10\,730}$ $= 0{,}39$ P(UG) × P(RF) $= \frac{8\,120}{10\,730} \times \frac{6\,101}{10\,730}$ $= 0{,}43$ **OR** $= 0{,}76 \times 0{,}57$ $= 0{,}4332$ P(UG and RF) ≠ P(UG) × P(RF) The event of being an undergraduate and receiving financial aid are NOT independent.	✓ P(UG and RF) ✓ $\frac{4\,222}{10\,730} \times \frac{6101}{10\,730}$ ✓ P(UG and RF) ≠ P(UG) × P(RF) ✓ conclusion (4) **[10]**

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QUESTION 7

7.1	Number of ways $= 8 \times 8$ $= 64$ If learner writes all the numbers out and then counts then, full marks Answer will be 11 12 13 14 15 16 17 18 21 22 23 24 25 26 27 28 31 32 33 34 35 36 37 38 41 42 43 44 45 46 47 48 51 52 53 54 55 56 57 58 61 62 63 64 65 66 67 68 71 72 73 74 75 76 77 78 81 82 83 84 85 86 87 88 64 ways to write a number	✓✓ answer (2) If candidate writes 8×7: 1/2
7.2	Number of ways for a 4-digit number $= 8 \times 7 \times 6 \times 5$ $= 1\ 680$ Answer only: 3 / 3 **OR** Number of ways for a 4-digit number $= \frac{8!}{(8-4)!}$ $= \frac{8!}{4!}$ $= 1680$	✓ multiplication rule ✓ $8 \times 7 \times 6 \times 5$ ✓ answer (3) ✓✓ $\frac{8!}{(8-4)!}$ or $\frac{8!}{4!}$ ✓ 1680
7.3	Numbers between 4 000 and 5 000 $= 1 \times 8 \times 8 \times 8$ $= 512$ Answer only: 3 / 3 If leave answer as: $1 \times 8 \times 8 \times 8$ OR $8 \times 8 \times 8$: 2 / 3	✓ 1 ✓ 8^3 ✓ answer (3) **[8]**

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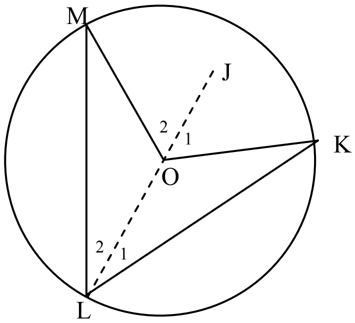
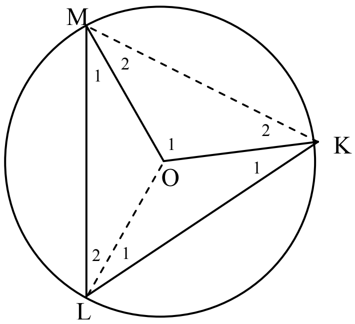
QUESTION 8

8.1	Construct OL and extend to J $\hat{L}_2 = L\hat{M}O$ (MO = OL) $\hat{O}_2 = L\hat{M}O + \hat{L}_2$ (ext $\angle$ of ΔOML) $\hat{O}_2 = 2\hat{L}_2$ Similarly $\hat{O}_1 = 2\hat{L}_1$ $\hat{O}_1 + \hat{O}_2 = 2\hat{L}_1 + 2\hat{L}_2$ $K\hat{O}M = 2(\hat{L}_1 + \hat{L}_2)$ $K\hat{O}M = 2K\hat{L}M$  If candidate writes: $K\hat{O}M = 2K\hat{L}M$ ($\angle$ circ centre = 2$\angle$ at circumference): 0 / 6 Note: Construction can be stated or drawn. **OR** Join M to K and O to L $\hat{L}_2 = \hat{M}_1 = x$ (MO = OL) $\hat{K}_2 = \hat{M}_2 = y$ (MO = OK) $\hat{K}_1 = \hat{L}_1 = z$ (OL = OK) $\hat{O}_1 = 180° - 2y$ ($\angle$ sum Δ) $2y + 2z + 2x = 180°$ ($\angle$ sum Δ) $2z + 2x = 180° - 2y$ $2(z + x) = 180° - 2y$ $2(\hat{L}_1 + \hat{L}_2) = K\hat{O}M$ $K\hat{O}M = 2K\hat{L}M$  	✓ construction ✓ S/R ✓ S/R ✓ $\hat{O}_1 = 2\hat{L}_1$ ✓ $\hat{O}_1 + \hat{O}_2 = 2\hat{L}_1 + 2\hat{L}_2$ ✓ $K\hat{O}M = 2(\hat{L}_1 + \hat{L}_2)$ (6)

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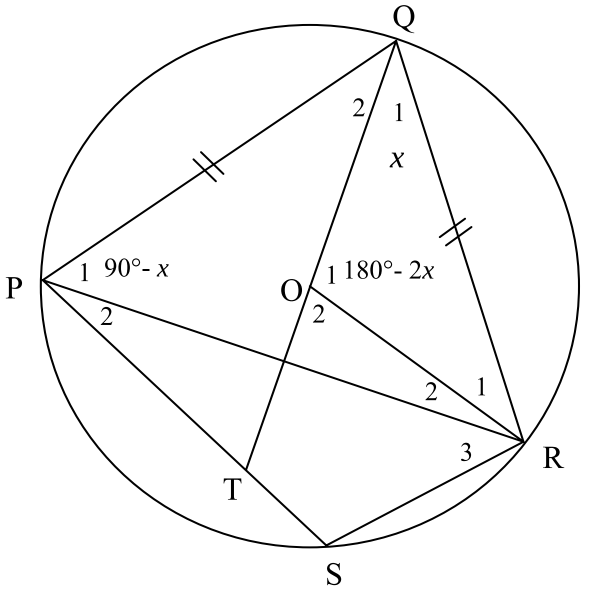

8.2.1	$\hat{R}_1 = x$ (∠'s opp = radii) $\hat{O}_1 = 180° - 2x$ (∠ sum in ΔQRT) $\hat{P}_1 = 90° - x$ (∠ circle centre = twice ∠ at circumference)	✓ S/R ✓ $\hat{O}_1 = 180° - 2x$ ✓ S/R $\hat{P}_1 = 90° - x$ (3)
8.2.2	PQ = QR (given) $Q\hat{R}P = 90° - x$ (∠ opp = sides in Δ) $P\hat{Q}R = 2x$ (∠ sum in ΔPQR) $x + \hat{Q}_2 = 2x$ $\hat{Q}_2 = x$ TQ bisects $P\hat{Q}R$	✓S/R ✓ Statement ✓ $\hat{Q}_2 = x$ (3)
8.2.3	$P\hat{Q}R = 2x$ $\hat{S} = 180° - 2x$ (opp ∠'s of cyclic quad are supplementary) $\hat{O}_1 = 180° - 2x$ $\hat{O}_1 = \hat{S}$ STOR is a cyclic quadrilateral … (converse – ext ∠ of cyclic quad = int opp. ∠) (ext ∠ quad = int opp ∠)	✓S/R ✓Statement ✓Reason (3) **[15]**

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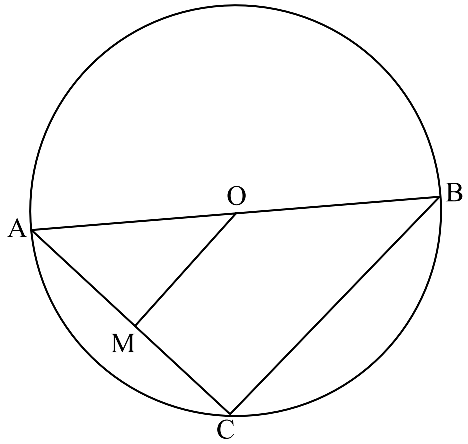
QUESTION 9



9.1	$B\hat{C}A = 90°$ (∠'s in a semi-circle)	✓ answer (1)
9.2.1	$AC = \sqrt{10^2 - 8^2}$ (Pythagoras) $= \sqrt{36}$ $= 6$ AM = 3 (line from circle centre ⊥ chord bisects chord **OR** midpoint theorem)	✓ diameter = 10 ✓ AC ✓ AM (3)
9.2.2	$OM = \sqrt{5^2 - 3^2}$ (Pythagoras) $= 4$ (**OR** midpoint theorem) Area ΔAOM : Area ΔABC $= \frac{1}{2}.4.3 \ : \ \frac{1}{2}.8.6$ $= 6 : 24$ $= 1 : 4$ **OR** Area ΔAOM : Area ΔABC $= \frac{1}{2}.AM.OM.\sin O\hat{A}M \ : \ \frac{1}{2}.AC.AB.\sin B\hat{A}C$ $= \frac{1}{2}.4.3 \ : \ \frac{1}{2}.8.6$ $= 6 : 24$	✓ OM ✓ substitution ✓ answer (3) **[7]**

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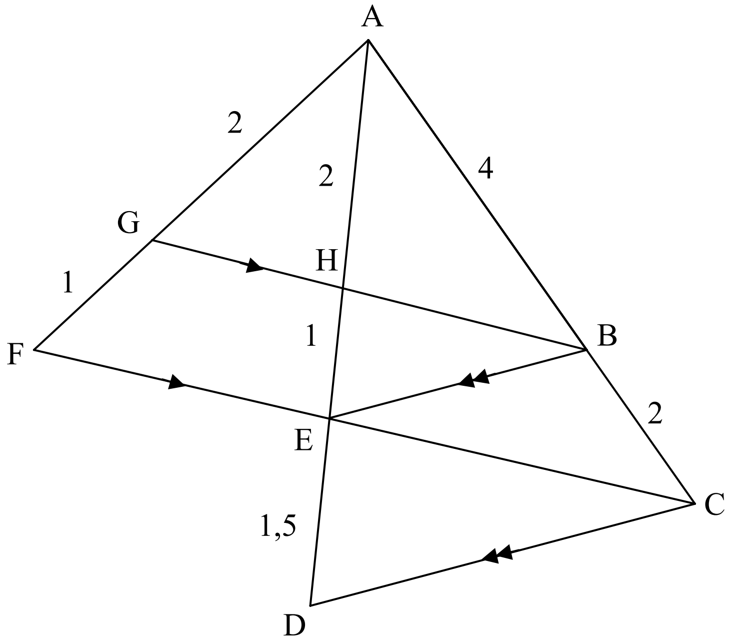
QUESTION 10



10.1.1	$\frac{AH}{HE}=\frac{2}{1}$ AH = 2y HE = y $\frac{AE}{ED}=\frac{2}{1}$ ED = 1,5 y $\frac{AH}{ED}=\frac{2}{1{,}5}$ $\frac{AH}{ED}=\frac{4}{3}$	(GHB || FEC) (BE || CD) If learner stops at 2 : 1,5 : no penalty	✓ statement ✓ reason ✓ ED = 1,5y ✓ answer (4)
10.1.2	$\frac{BE}{CD}=\frac{4}{6}$ $=\frac{2}{3}$	(ΔAEB ||| ΔADC)	✓ answer ✓reason (2)
10.2	HE = 2 cm AH = 4 cm ED = 3 cm AD.HE = (AH + HE + ED).HE = (4 + 2 + 3).(2) = 18	(given)	✓ AH and ED ✓AD = AH + HE + ED (2) **[8]**

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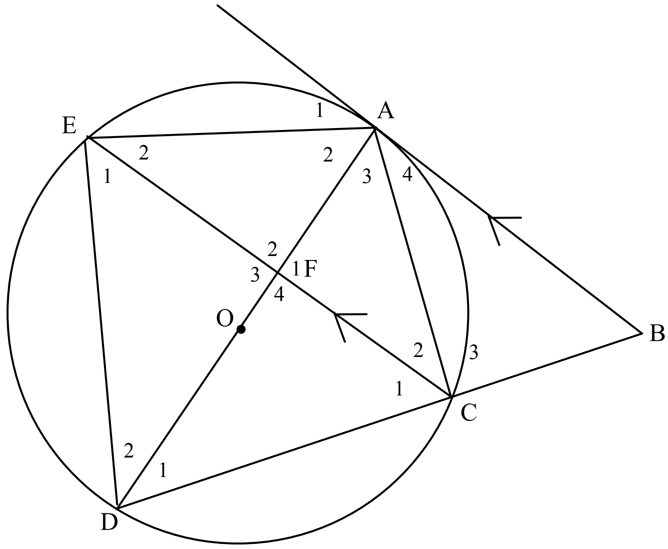
QUESTION 11



11.1	$\hat{D}_1 = \hat{A}_4$ (tan-chord theorem) $= \hat{C}_2$ (alt ∠'s , BA || CE) **OR** $\hat{C}_2 = \hat{D}_2$ (∠'s in same seg) $= \hat{A}_1$ (tan-chord theorem) $= \hat{E}_2$ (alt ∠'s , BA || CE) $= \hat{D}_1$ (∠'s in same seg) **OR** $\hat{A}_3 + \hat{A}_4 = 90°$ (tan ⊥ rad) $\hat{F}_1 = 90°$ (AB || EC; coint ∠s) In ΔAFC: $\hat{C}_2 = 90° - \hat{A}_3$ (∠ sum Δ) $\hat{C}_1 + \hat{C}_2 = 90°$ (∠s in semi circle) In ΔADC: $\hat{D}_1 = 90° - \hat{A}_3$ (∠ sum Δ) $\hat{D}_1 = \hat{C}_2$	✓ Statement ✓ Reason ✓ S/R (3) ✓ Statement ✓ Reason ✓ S/R (3)

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11.2	In ΔACF and ΔADC 1. $\hat{A}_3$ is common 2. $\hat{C}_2 = \hat{D}_1$ (proved) $\Delta ACF \parallel\!\mid \Delta ADC$ ($\angle\angle\angle$) **OR** In ΔACF and ΔADC 1. $\hat{A}_3$ is common 2. $\hat{C}_2 = \hat{D}_1$ (proved) 3. $\hat{F}_1 = A\hat{C}D$ (remaining $\angle$s in triangles) $\Delta ACF \parallel\!\mid \Delta ADC$	✓ $\hat{A}_3$ is common ✓ $\hat{C}_2 = \hat{D}_1$ ✓ Reason (3)
11.3	$\frac{AF}{AC} = \frac{AC}{AD}$ (sim Δ's $\therefore$ sides in proportion) $AF = \frac{AC.AC}{AD}$ $AC = AO = \frac{1}{2}AD$ (2radius = diameter) $AF = \frac{\frac{1}{2}AD.\frac{1}{2}AD}{AD}$ $AF = \frac{AD}{4}$ $4AF = AD$ **OR** ΔAOC is equilateral $\therefore A\hat{O}C = \hat{A}_3 = 60°$ $\cos 60° = \frac{AF}{AC} = \frac{1}{2}$ $AF = \frac{1}{2}AC = \frac{1}{2}AO$ $AF = \frac{1}{2}(\frac{1}{2}AD)$ (2radius = diameter) $AF = \frac{1}{4}AD$ $AD = 4AF$	✓ statement ✓ Statement ✓ Simplification ✓ Substitution (4) ✓ S/R ✓ Statement ✓ Simplification ✓ Substitution (4) **[10]**

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