



education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION

GRADE 12

MATHEMATICS P2

SEPTEMBER 2020

MARKS: 150

TIME: 3 HOURS

This question paper consists of 13 pages, an information sheet and an answer book of 20 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
4. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
5. If necessary, round off answers to TWO decimal places, unless stated otherwise.
6. Diagrams are NOT necessarily drawn to scale.
7. Answers only will NOT necessarily be awarded full marks.
8. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.

QUESTION 1

The table below gives the average exchange rate and the average monthly oil price for the year 2010.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Exchange rate in R/S	7.5	7.7	7.2	7.4	7.7	7.7	7.6	7.3	7.1	7.0	6.9	6.8
Oil price in \$	69.9	68.0	72.9	70.3	66.3	67.1	67.9	68.3	71.3	73.6	76.0	81.0

- 1.1 Draw a scatterplot to represent the exchange rate (in R/S) versus the oil price (in \$). (3)
- 1.2 Determine the equation of the least square regression line. (3)
- 1.3 Calculate the value of the correlation coefficient. (1)
- 1.4 Comment on the strength of the relationship between the exchange rate (in R/S) and the oil price (in \$). (2)
- 1.5 Determine the mean oil price. (1)
- 1.6 Determine the standard deviation of the oil price. (1)
- 1.7 Generally there is a concern from the public when the oil price is higher than two standard deviations from the mean.

In which months would the public have been concerned? (2)
[13]

QUESTION 2

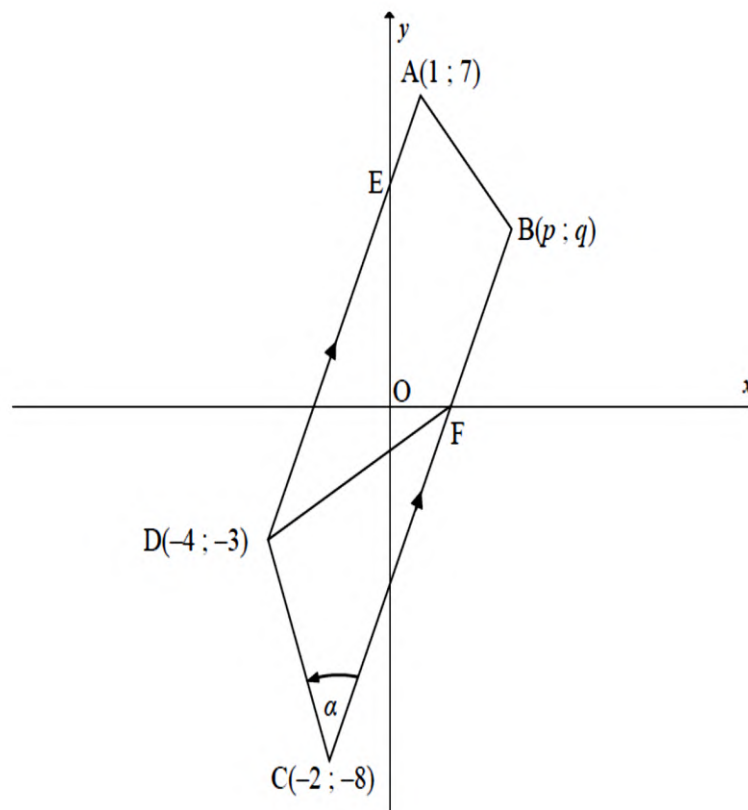
The average percentage of 150 learners for all their subjects is summarised in the cumulative frequency below.

PERCENTAGE INTERVAL	CUMULATIVE FREQUENCY
$0 < x \leq 10$	5
$10 < x \leq 20$	21
$20 < x \leq 30$	50
$30 < x \leq 40$	70
$40 < x \leq 50$	88
$50 < x \leq 60$	110
$60 < x \leq 70$	135
$70 < x \leq 80$	142
$80 < x \leq 90$	147
$90 < x \leq 100$	150

- 2.1 Draw the ogive (cumulative frequency graph) to represent the above data on the grid provided in the ANSWER BOOK. (4)
- 2.2 Use the ogive to approximate the following:
- 2.2.1 The number of learners who scored less than 85% (2)
- 2.2.2 The median (1)
- [7]**

QUESTION 3

In the diagram below shows, quadrilateral ABCD with $AD \parallel BC$. The coordinates of the vertices are $A(1; 7)$; $B(p; q)$; $C(-2; -8)$ and $D(-4; -3)$. BC intersects the x-axis at F. $\angle DCB = \alpha$.



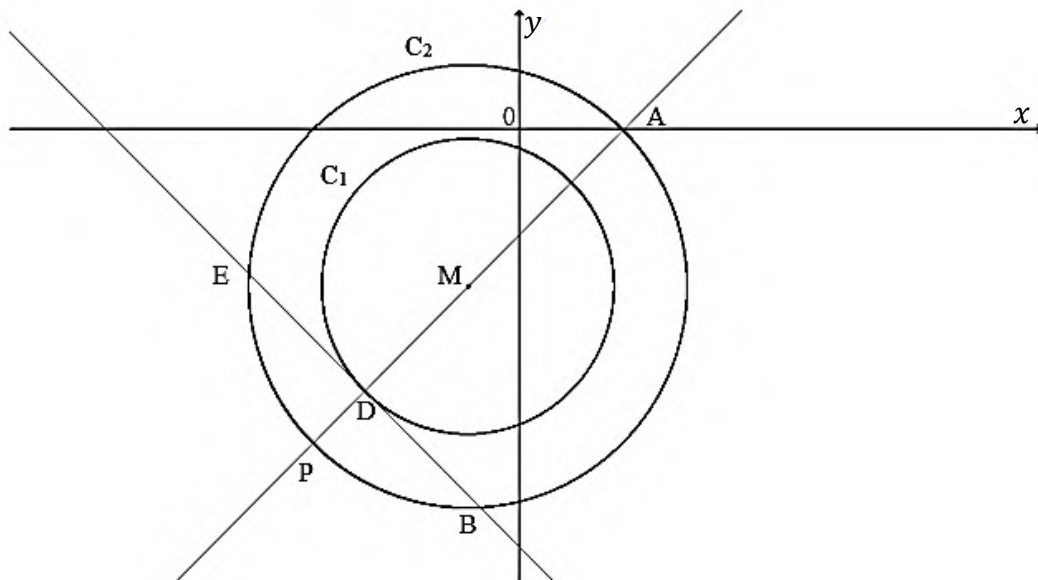
- 3.1 Calculate the gradient of AD. (2)
- 3.2 Determine the equation of BC in the form $y = mx + c$. (3)
- 3.3 Determine the coordinates of point F. (2)
- 3.4 $AB'CD$ is a parallelogram with B' on BC. Determine the coordinates of B' , using a transformation $(x; y) \rightarrow (x + a; y + b)$ that sends A to B' . (2)
- 3.5 Show that $\alpha = 48,37^\circ$. (4)
- 3.6 Calculate the area of $\triangle DCF$. (6)

[19]

QUESTION 4

Circle C_1 and C_2 in the figure below have the same centre M . P and A are points on C_2 .

PM intersects C_1 at D . The tangent BD to C_1 intersects C_2 at B and E . The equation of circle C_1 is given by $x^2 + 2x + y^2 + 6y + 2 = 0$ and the equation of line PM is $y = x - 2$.

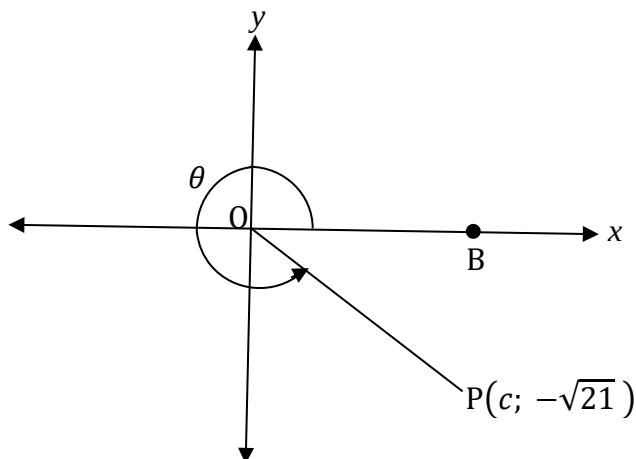


- 4.1 Calculate the coordinates of centre M . (3)
- 4.2 Determine the radius of circle C_1 . (1)
- 4.3 Determine the coordinates of D , the point where line PM and circle C_1 intersect. (5)
- 4.4 Give a reason why $\widehat{MDB} = 90^\circ$. (1)
- 4.5 If it is given that $DB = 4\sqrt{2}$, determine MB , the radius of circle C_2 . (4)
- 4.6 Write down the equation of C_2 in the form $(x - a)^2 + (y - b)^2 = r^2$. (1)
- 4.7 Is the point $F(2\sqrt{5}; 0)$ inside circle C_2 ? Support your answer with calculations. (4)
- 4.8 Determine the gradient of the tangent to circle C_2 at point P . (2)

[21]

QUESTION 5

- 5.1 In the diagram, P is the point $(c; \sqrt{21})$ such that $OP = 5$ units.
 $\widehat{BOP} = \theta$ as indicated.



- 5.1.1 Calculate the numerical value of c . (2)

- 5.1.2 Determine **(without the use of a calculator)**, the numerical value of the following:

- a) $\cos \theta$ (1)
 b) $\tan \theta + \sin^2 \theta$ (2)
 c) $\sin 2\theta$ (2)

- 5.2 Simplify **(without the use of a calculator)**:

$$\frac{\sin(x-180^\circ) \cdot \tan x \cdot \cos 690^\circ}{\cos^2(x-90^\circ)}$$

(5)
[12]

QUESTION 6

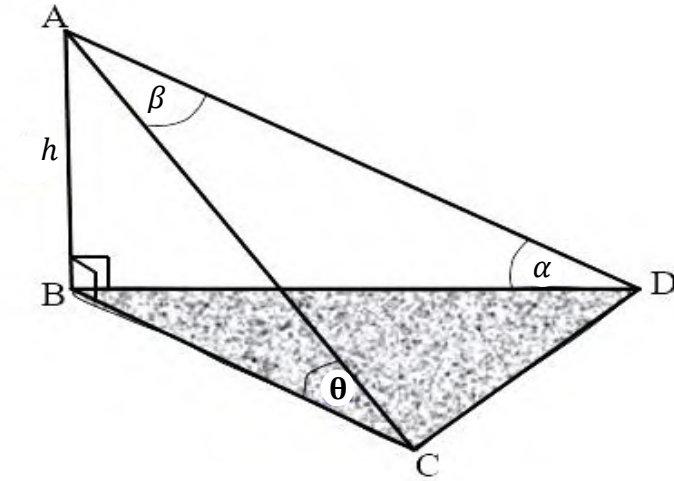
- 6.1 Prove the identity: $\frac{2\sin^2 x}{2\tan x - \sin 2x} = \frac{\cos x}{\sin x}$ (5)

- 6.2 Show that: $\sin^2 20^\circ + \sin^2 40^\circ + \sin^2 80^\circ = \frac{3}{2}$

(Hint: $40^\circ = 60^\circ - 20^\circ$ and $80^\circ = 60^\circ + 20^\circ$) (7)
[12]

QUESTION 7

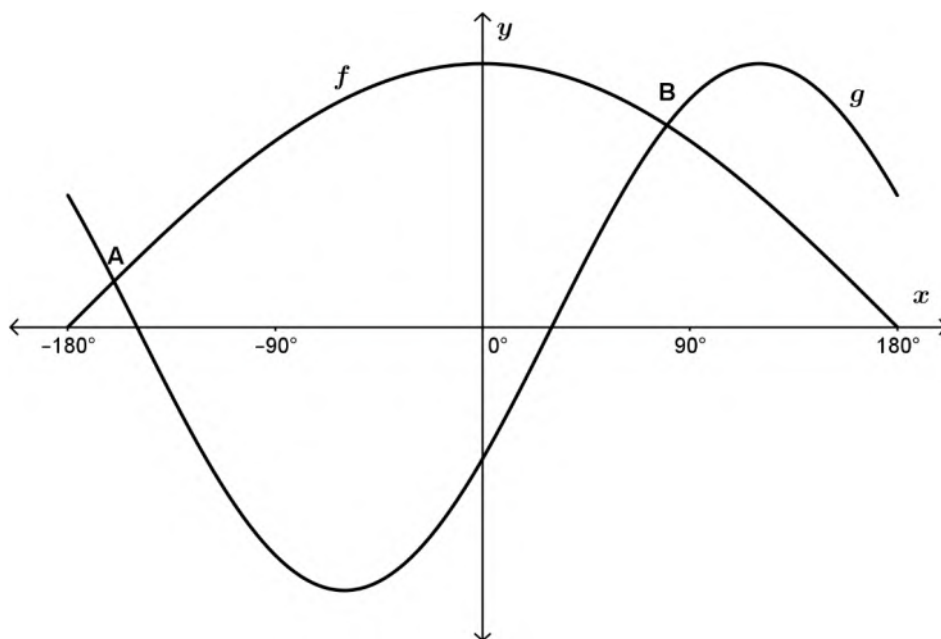
In the figure below Thabo is standing at a point A on top of building AB that is h (m) high. He observes two cars, C and D that are in the same horizontal plane as B. The angle of elevation from C to A is θ and the angle of elevation from D to A is α . $\hat{CAD} = \beta$.



- 7.1 Calculate the length of AC in terms of h and θ . (2)
- 7.2 Calculate the length of AD in terms of h and α . (2)
- 7.3 Determine the distance between the two cars, which is the length of CD in terms of α , θ , β and h . (3)
- [7]

QUESTION 8

In the diagram are the graphs of the functions $f(x) = \cos \frac{x}{2}$ and $g(x) = \sin(x - 30^\circ)$ for $x \in [-180^\circ; 180^\circ]$. The curves intersect at A and B.

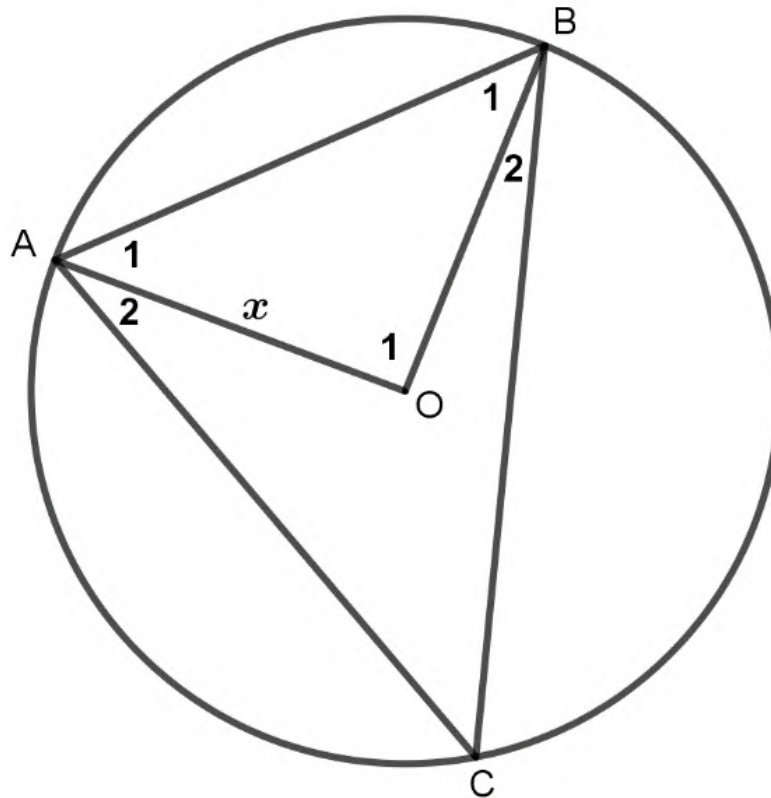


8.1 Calculate the x -coordinates of the points A and B. (6)

8.2 Determine the values of $x \in [-90^\circ; 180^\circ]$, for which $g(x) \cdot f(x) < 0$. (3)
[9]

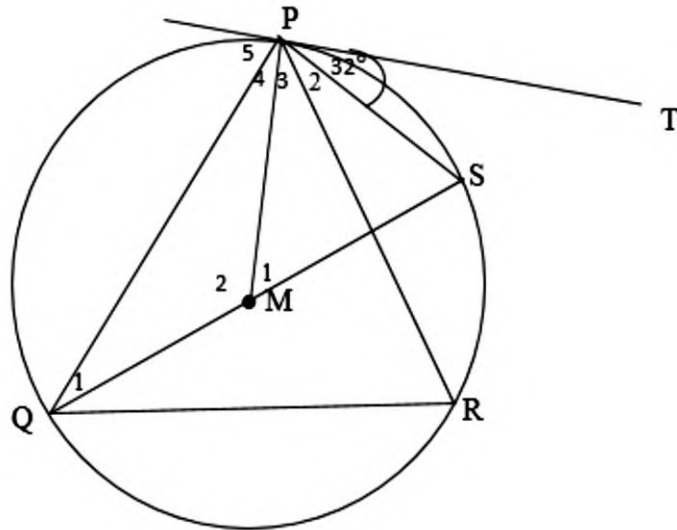
QUESTION 9

A, B and C are three points on the circle with centre O such that $AB = BC = \frac{3}{2} AO$.
 $AO = x$.



- 9.1 Calculate the size of $\hat{O}_1$ rounded off to the nearest degree. (5)
- 9.2 If $\hat{O}_1 = 97^\circ$ and $x = 10$ cm, calculate the length of AC correct to two decimal places. (4)

- 9.3 In the diagram, TP is a tangent to the circle with centre M at P. QS is a diameter of the circle and R is on the circumference of the circle. $\widehat{TPS} = 32^\circ$.



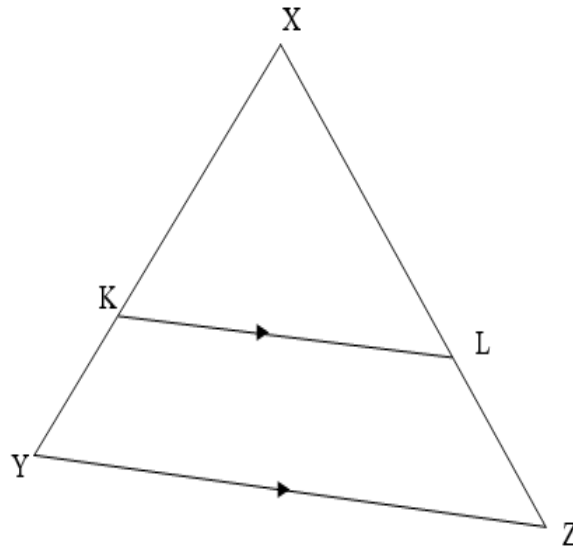
Calculate the following, giving reasons:

- | | | |
|-------|-----------------|-------------|
| 9.3.1 | $\widehat{Q}_1$ | (2) |
| 9.3.2 | $\widehat{P}_4$ | (2) |
| 9.3.3 | $\widehat{M}_1$ | (2) |
| 9.3.4 | $\widehat{R}$ | (4) |
| | | [19] |

QUESTION 10

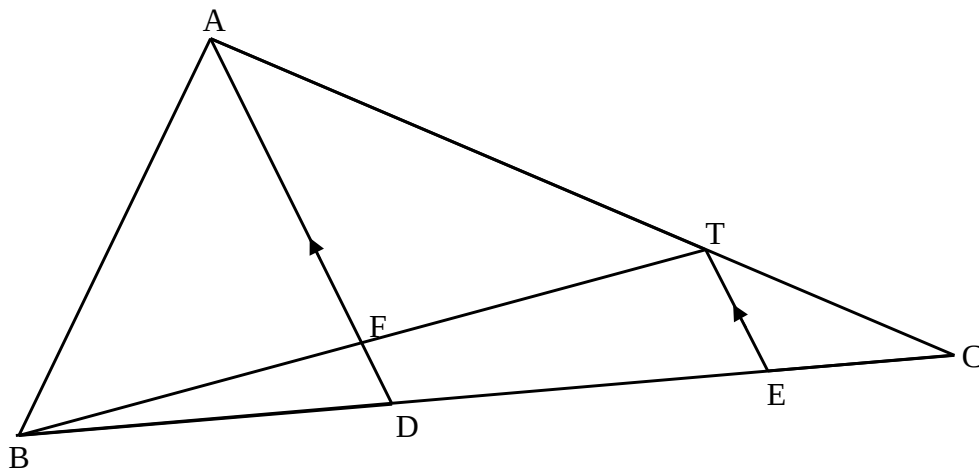
10.1 Complete the following statement:
 If two triangles are equiangular, then the corresponding sides are ... (1)

10.2 Use the diagram to prove the theorem which states that a line drawn parallel to one side of a triangle divides the other two sides proportionally, that is prove that $\frac{XK}{KY} = \frac{XL}{LZ}$.



(6)

10.3 In the figure, D is a point on side BC of $\triangle ABC$ such that $BD = 6$ cm and $DC = 9$ cm. T and E are points on AC and DC respectively such that $TE \parallel AD$ and $AT : TC = 2 : 1$



10.3.1 Show that D is the midpoint of BE. (3)

10.3.2 If $FD = 2$ cm, calculate the length of TE. (3)

10.3.3 Calculate the numerical value of:

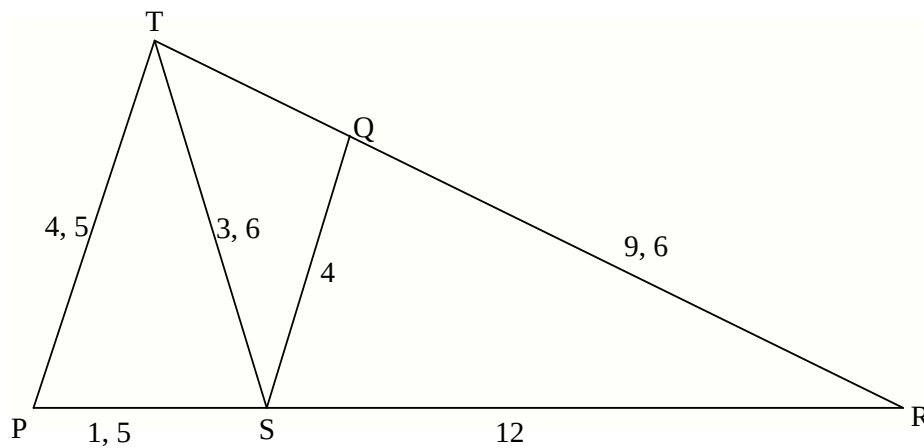
(a) $\frac{\text{Area of } \triangle ADC}{\text{Area of } \triangle ABD}$ (3)

(b) $\frac{\text{Area of } \triangle TEC}{\text{Area of } \triangle ABC}$ (3)

[19]

QUESTION 11

In the diagram, TPR is a triangle with $TP = 4,5$ units. Points Q and S are on TR and PR respectively such that $QR = 9,6$ units, $QS = 4$ units, $TS = 3,6$ units, $PS = 1,5$ units and $SR = 12$ units.



11.1 Prove that PT is a tangent to the circle which passes through the points T, S and R. (7)

11.2 Calculate the length of TQ. (5)

[12]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + in)$$

$$A = P(1 - in)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2}[2a + (n - 1)d]$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; \quad r \neq 1$$

$$S_\infty = \frac{a}{1 - r}; \quad -1 < r < 1$$

$$F = \frac{x[(1 + i)^n - 1]}{i}$$

$$P = \frac{x[1 - (1 + i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

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

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

$$(x - a)^2 + (y - b)^2 = r^2$$

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{area } \triangle ABC = \frac{1}{2} ab \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2\sin \alpha \cos \alpha$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$



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**PREPARATORY EXAMINATION/
VOORBEREIDENDE EKSAMEN**

GRADE/GRAAD 12

**MATHEMATICS P2/
WISKUNDE V2**

SEPTEMBER 2020

MARKS/PUNTE: 150

**MARKING GUIDELINES/
NASIENRIGLYNE**

**This marking guidelines consists of 13 pages./
Hierdie nasienriglyne bestaan uit 13 bladsye.**

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

NOTA:

- As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.
- As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.
- Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.
- Om antwoorde/waardes te aanvaar om 'n probleem op te los, word NIE toegelaat NIE.

GEOMETRY/MEETKUNDE	
S	A mark for a correct statement (A statement mark is independent of a reason)
	<i>'n Punt vir 'n korrekte bewering ('n Punt vir 'n bewering is onafhanklik van die rede)</i>
R	A mark for the correct reason (A reason mark may only be awarded if the statement is correct)
	<i>'n Punt vir 'n korrekte rede ('n Punt word slegs vir die rede toegeken as die bewering korrek is)</i>
S/R	Award a mark if statement AND reason are both correct
	<i>Ken 'n punt toe as die bewering EN die rede beide korrek is</i>

QUESTION/VRAAG 1

1.1	Scatter Plot/Spreidiagram Oil Price/Olieprys Exchange rate/Wisselkoers in R/\$	✓ 4 points correctly plotted ✓ 9 points correctly plotted ✓ All points (3)
1.2	$y = 158,67 - 11,96x$	✓✓✓ Correct equation (3)
1.3	$r = -0,91$	✓ value of r (1)
1.4	Exchange rate increase, oil price decrease/Wisselkoers verhoog, olieprys verlaag OR/OF Strong Negative correlation/Sterk negatiewe korrelasie	✓ ✓ reason (2)
1.5	$y = 71,05$	✓ $y = 71,05$ (1)
1.6	Standard deviation/Standaard afwyking : $\sigma = 4,09$	✓ $\sigma = 4,09$ (1)
1.7	$71,05 + 2(4,09) = 79,23$ (With calculator 79,22) December	✓ 79,23 ✓ December/Desember (2)
		[13]

QUESTION/VRAAG 2

2.1	OGIVE/OGIEF	✓grouded ✓Cf ✓upper limit ✓ curve (4)
2.2.1	(8;144) 144 below 85 % (accept/aanvaar 144-146)	✓(8;144) ✓ 144 (2)
2.2.2	$Q_2 = 42,77$ (accept/aanvaar 41-43)	✓$Q_2 = 42,77$ (1)
		[7]

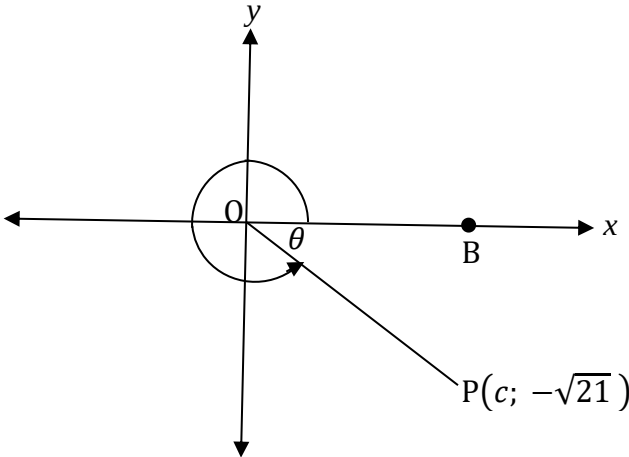
QUESTION/VRAAG 3

3.1	$M_{AD} = \frac{7-(-3)}{1-(-4)}$ $= 2$	✓ Substitution into the correct formula ✓ Answer (2)
3.2	AD// BC $M_{AD} = M_{BC} = 2$ $-8 = 2(2) + c$ $\therefore y = 2x - 4$	✓ $M_{BC} = 2$ ✓ sub ✓ Answer (3)
3.3	At F $y = 0$ $0 = 2x - 4$ $\therefore x = 2$ $\therefore F(2; 0)$	✓ $0 = 2x - 4$ ✓ $x = 2$ (2)
3.4	$B(x; y) - 7 \quad C(x + 2; y - 5)$ $A(1; 7) \rightarrow B'(3; 2)$ OR $x_B = -2 + (1 + 4) = 3$ $y_B = -8 + (7 + 3) = 2$	✓ ✓ $B'(3; 2)$ (2)
3.5	$M_{BC} = \tan \theta = 2$ $\theta = 63,43^\circ$ $M_{DC} = \frac{-8 - (-3)}{-2 - (-4)} = \frac{-5}{2}$ $\tan \beta = \frac{-5}{2}$ $\beta = 180^\circ - 68,20^\circ = 111,80^\circ$ $\alpha = 111,80^\circ - 63,43^\circ = 48,37^\circ$	✓ $\theta = 63,43^\circ$ ✓ $\frac{-5}{2}$ ✓ $\beta = 111,80^\circ$ ✓ $\alpha = 48,37$ (4)
3.6	$DC = \sqrt{(-4 + 2)^2 + (-3 + 8)^2}$ $= \sqrt{29}$ $CF = \sqrt{(-2 - 2)^2 + (-8 - 0)^2}$ $= \sqrt{80}$ $\text{Area/Oppvl } \triangle DCF = \frac{1}{2} DC \cdot CF \sin \alpha$ $= \frac{1}{2} \sqrt{29} \cdot \sqrt{80} \sin 48,37^\circ$ $= 18 \text{ units/eenhede}$	✓ sub correct formula ✓ $\sqrt{29}$ ✓ sub correct formula ✓ $\sqrt{80}$ ✓ sub correct formula ✓ 18 units (6)
		[19]

QUESTION/VRAAG 4

4.1	$x^2 + y^2 + 2x + 6y + 2 = 0$ $x^2 + 2x + 1 + y^2 + 6y + 9 = -2 + 10$ $(x + 1)^2 + (y + 3)^2 = 8$ $M(-1; -3)$	$\checkmark 8$ $\checkmark\checkmark M(-1; -3)$ (3)
4.2	$r = \sqrt{8}$	$\checkmark r = \sqrt{8}$ (1)
4.3	$x^2 + (x - 2)^2 + 2x + 6(x - 2) + 2 = 0$ $2x^2 + 4x - 6 = 0$ $x^2 + 2x + 3 = 0$ $(x + 3)(x - 1) = 0$ $x = -3 \text{ or } x \neq 1$ $y = -3 - 2 = -5$ $\therefore D(-3; -5)$	$\checkmark$ substitution $\checkmark x^2 + 2x + 3 = 0$ $\checkmark (x + 3)(x - 1) = 0$ $\checkmark\checkmark D(-3; -5)$ (5)
4.4	Angle between radius/diameter and tangent/ <i>Hoek tussen radius/deursnee en raaklyn</i>	$\checkmark R$ (1)
4.5	$MB^2 = MD^2 + DB^2$ Pyth $= (\sqrt{8})^2 + 4(\sqrt{2})^2$ $= 40$ $MB = \sqrt{40}$ radius of Circle/radius van sirkel C_2	$\checkmark S$ $\checkmark (\sqrt{8})^2 + 4(\sqrt{2})^2$ $\checkmark 40$ $\checkmark MB = \sqrt{40}$ (4)
4.6	$(x + 1)^2 + (y + 3)^2 = 40$	$\checkmark$ Equation of C_2 (1)
4.7	Distance from/Afstand van $(2\sqrt{5}; 0)$ to centre/tot middelpunt $= \sqrt{(2\sqrt{5} + 1)^2 + (0 + 3)^2}$ $= 6,24$ $6,24 < 6,32 (\sqrt{40})$ Distance to centre < radius of circle/Afstand tot middelpunt < radius van die sirkel $\therefore (2\sqrt{5}; 0)$ lies inside/lê binne	$\checkmark$ correct sub $\checkmark 6,24$ $\checkmark 6,24 < 6,32 (\sqrt{40})$ $\checkmark$ lies inside (4)
4.8	$M_{MDP} = \frac{-3 - (-5)}{-1 - (-3)} = \frac{2}{2} = 1$ $\therefore M \text{ tangent} = -1$	$\checkmark M_{MDP} = 1$ $\checkmark M \text{ tangent} = -1$ (2)
		[21]

QUESTION/VRAAG 5

5.1.1	 $c^2 + (\sqrt{21})^2 = 5^2$ $c^2 = 25 - 21$ $c^2 = 4$ $\therefore c = 2$	✓ Subst. into pyth ✓ Answer (2)
5.1.2 a)	$\cos \theta = \frac{2}{5}$	✓ Answer (1)
b)	$\frac{-\sqrt{21}}{2} + \left(\frac{-\sqrt{21}}{5}\right)^2$ $-5\sqrt{21} + 42/50$	✓ $\frac{-\sqrt{21}}{2} + \left(\frac{-\sqrt{21}}{5}\right)^2$ ✓ Answer (2)
c)	$2\sin \theta \cos \theta$ $= 2 \left(\frac{-\sqrt{21}}{5}\right) \left(\frac{2}{5}\right)$ $= \frac{-4\sqrt{21}}{25}$	✓ $2 \left(\frac{-\sqrt{21}}{5}\right) \left(\frac{2}{5}\right)$ ✓ Answer (2)
5.2	$\frac{(-\sin x) \cdot \tan x \cdot \cos(360^\circ - 30^\circ)}{(-\sin x)^2}$ $= \frac{-\sin x \cdot \tan x (\cos 30^\circ)}{\sin^2 x}$ $= \frac{-\sqrt{3}}{2} \tan x \div \sin x$ $= \frac{-\sqrt{3}}{2 \cos x}$	✓ $-\sin x$ ✓ $(-\sin x)^2$ ✓ $\frac{-\sqrt{3}}{2}$ ✓ ✓ $\frac{-\sqrt{3}}{2 \cos x}$ (5)
		[12]

QUESTION/VRAAG 6

6.1	$LHS = \frac{2 \sin^2 x}{2 \frac{\sin x}{\cos x} - 2 \sin x \cos x}$ $= \frac{2 \sin^2 x}{2 \sin x \left(\frac{1}{\cos x} - \cos x \right)}$ $= \frac{\sin x}{1 - \cos^2 x} \quad \therefore LHS = RHS$ $\frac{\sin x}{\cos x}$ $= \sin x \times \frac{\cos x}{\sin^2 x}$ $= \frac{\cos x}{\sin x}$	✓ $\frac{\sin x}{\cos x}$ ✓ $2 \sin x \cos x$ ✓ $2 \sin x \left(\frac{1}{\cos x} - \cos x \right)$ ✓ $\frac{\sin x}{1 - \cos^2 x}$ ✓ $\sin^2 x$ (5)
6.2	$\sin^2 20^\circ + \sin^2 40^\circ + \sin^2 80^\circ$ $= \sin^2 20^\circ + [\sin(60^\circ - 20^\circ)]^2 + [\sin(60^\circ + 20^\circ)]^2$ $= \sin^2 20^\circ + [\sin 60^\circ \cos 20^\circ - \cos 60^\circ \sin 20^\circ]^2$ $+ [\sin 60^\circ \cos 20^\circ + \cos 60^\circ \sin 20^\circ]^2$ $= \sin^2 20^\circ + \left[\frac{\sqrt{3}}{2} \cos 20^\circ - \frac{1}{2} \sin 20^\circ \right]^2$ $+ \left[\frac{\sqrt{3}}{2} \cos 20^\circ + \frac{1}{2} \sin 20^\circ \right]^2$ $= \frac{3}{2} \sin^2 20^\circ + \frac{3}{2} \cos^2 20^\circ$ $= \frac{3}{2} (\sin^2 20^\circ + \cos^2 20^\circ)$ $= \frac{3}{2} (1)$ $= \frac{3}{2}$	✓✓ compound ✓ sub of special angle ✓ simplification ✓ common factor ✓ square identity ✓ answer (7)
		[12]

QUESTION/VRAAG 7

7.1	In ΔABC $\sin \theta = \frac{h}{AC}$ $\therefore AC = \frac{h}{\sin \theta}$	✓ trig ratio ✓ answer (2)
7.2	In ΔABD $\sin \alpha = \frac{h}{AD}$ $\therefore AD = \frac{h}{\sin \alpha}$	✓ trig ratio ✓ answer (2)
7.3	$CD^2 = AC^2 + AD^2 - 2AC \cdot AD \cos \beta$ $= \left(\frac{h}{\sin \theta}\right)^2 + \left(\frac{h}{\sin \alpha}\right)^2 - 2 \cdot \frac{h}{\sin \theta} \cdot \frac{h}{\sin \alpha} \cos \beta$ $= \frac{h^2}{\sin^2 \theta} + \frac{h^2}{\sin^2 \alpha} - \frac{2h^2 \cos \beta}{\sin \theta \sin \alpha}$	✓ cosine rule ✓ substitution ✓ answer (3)
		[7]

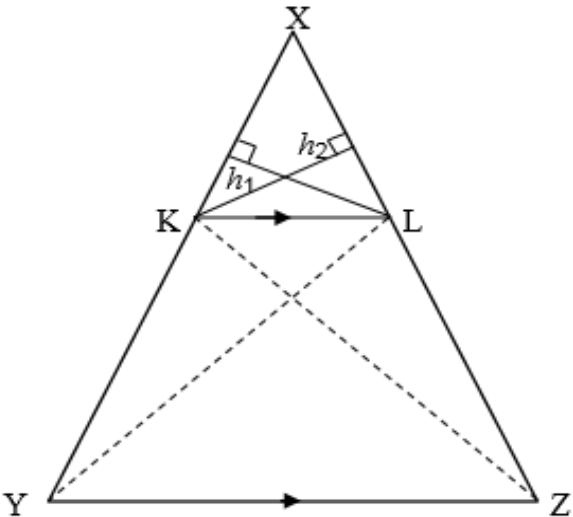
QUESTION/VRAAG 8

8.1	$\cos \frac{x}{2} = \sin(x - 30^\circ)$ $= \cos[(90^\circ - (x - 30^\circ))]$ $= \cos(120^\circ - x)$ $\therefore \frac{x}{2} = 120^\circ - x + 360^\circ \cdot k$ $x = 240^\circ - 2x + 720^\circ \cdot k$ $x = 80^\circ + 240^\circ \cdot k$ OR $\frac{x}{2} = 360^\circ - (120^\circ - x) + 360^\circ \cdot k$ $\frac{x}{2} = 360^\circ - 120^\circ + x + 360^\circ \cdot k$ $\frac{x}{2} = 240^\circ + x + 360^\circ \cdot k$ $x = 480^\circ + 2x + 720^\circ \cdot k$ $-x = 480^\circ + 720^\circ \cdot k$ $\therefore x = -480^\circ - 720^\circ \cdot k$ where/waar $k \in \mathbb{Z}$ $x_A = -160^\circ$ and/en $x_B = 80^\circ$	✓ $\cos(120^\circ - x)$ ✓ $80^\circ + 240^\circ \cdot k$ ✓ $240^\circ + x + 360^\circ \cdot k$ ✓ $-480^\circ - 720^\circ \cdot k$ ✓ $x_A = -160^\circ$ ✓ $x_B = 80^\circ$ (6)
8.2	$-150^\circ < x < 30^\circ$	✓ ✓ Critical values ✓ Notation (3)
		[9]

QUESTION/VRAAG 9

9.1	$AB^2 = AO^2 + BO^2 - 2(AO)(BO) \cos \hat{O}_1$ $\left(\frac{3}{2}x\right)^2 = x^2 + x^2 - 2x^2 \cos \hat{O}_1$ $\frac{9}{4}x^2 - 2x^2 = -2x^2 \cos \hat{O}_1$ $\cos \hat{O}_1 = \frac{1}{4}x^2 \div 2x^2$ $= \frac{1}{8}$ $\therefore \hat{O}_1 = 97^\circ$	✓ cosine rule ✓ substitution ✓ simplification ✓ $\frac{1}{8}$ ✓ $\hat{O}_1 = 97^\circ$ (5)
9.2	$\hat{C} = 48,5^\circ$ angle at centre/ <i>hoek by middelpunt</i> = twice angle at circ/ <i>twee keer hoek by sirk</i> $\hat{B}_1 + \hat{B}_2 = 83^\circ$ int angles of/ <i>binne hoeke van</i> Δ $\frac{AC}{\sin 83^\circ} = \frac{15}{\sin 48,5^\circ}$ $\therefore AC = 19,88$	✓ S ✓ S ✓ sine rule ✓ $AC = 19,88$ (4)
9.3.1	$\hat{Q}_1 = 32^\circ$ tan chord theorem/ <i>tan koordstelling</i>	✓ ✓ S/R (2)
9.3.2	$\hat{Q}_1 = \hat{P}_4 = 32^\circ$ angle opp = sides/ <i>hoeke teenoor = sye</i>	✓ ✓ S/R (2)
9.3.3	$\hat{M}_1 = \hat{Q}_1 + \hat{P}_4$ ext angle of Δ = op pint angles/ <i>Verl hoek van Δ = opp hoeke</i> $= 32^\circ + 32^\circ$ $\therefore \hat{M}_1 = 64^\circ$	✓ S ✓ answer (2)
9.3.4	$\hat{S} = 180^\circ - 122^\circ$ sum of angles of $\Delta = 180^\circ$ / <i>Som van hoeke van $\Delta = 180^\circ$</i> $\therefore \hat{S} = 58^\circ$ But/Maar $\hat{S} = \hat{R} = 58^\circ$ angle sub by same chord/ <i>hoek verv by dieselfde koord</i>	✓ ✓ S/R ✓ ✓ S/R (4)
		[19]

QUESTION/VRAAG 10

10.1	In the same proportion/ <i>In dieselfde verhouding</i>	✓ same proportion (1)
		
10.2	Const: Join KZ & LY & draw h_1 from K $\perp$ XL & h_2 from L $\perp$ KY Konst: Verbind KZ & LY & skets h_1 van K $\perp$ XL & h_2 van L $\perp$ KY Proof/Bewys $\frac{\text{Area/Oppvl } \Delta XKL}{\text{Area/Oppvl } \Delta LYK} = \frac{\frac{1}{2} XK \times h_1}{\frac{1}{2} KY \times h_2} = \frac{XK}{KY}$ $\frac{\text{Area/Oppvl } \Delta XKL}{\text{Area/Oppvl } \Delta KLZ} = \frac{\frac{1}{2} XL \times h_2}{\frac{1}{2} LZ \times h_2} = \frac{XL}{LZ}$ Area of ΔXKL = Area ΔXKL common/ Oppvl van ΔXKL = Oppvl ΔXKL algemeen But Area ΔLKY = Area ΔKLZ same base & height; LK // YZ/ Maar Oppvl ΔLKY = Oppvl ΔKLZ selfde basis & hoogte; LK // YZ $\frac{\text{Area/Oppvl } \Delta XKL}{\text{Area/Oppvl } \Delta LYK} = \frac{\text{Area/Oppvl } \Delta XKL}{\text{Area/Oppvl } \Delta KLZ}$ $\therefore \frac{XK}{KY} = \frac{XL}{LZ}$	✓ const $\checkmark \frac{\text{Area } \Delta XKL}{\text{Area } \Delta LYK} = \frac{XK}{KY}$ $\checkmark \frac{\text{Area } \Delta XKL}{\text{Area } \Delta KLZ} = \frac{XL}{LZ}$ ✓ S ✓ R ✓ S (6)

10.3.1	$\frac{ED}{DC} = \frac{AT}{AC} = \frac{2}{3}$ line // to one side of $\triangle$ / $DE = \frac{2}{3} \times 9$ lyn // aan die eenkant van $\triangle$ $= 6$ and/en $BD = 6$ given/gegee $\therefore D$ is the midpoint of BE /is the middelpunt van BE	$\checkmark \checkmark$ S/R $\checkmark$ answer	(3)
10.3.2	$BF = FT$ conv of midpoint theorem $FD = \frac{1}{2}TE$ midpoint theorem/middelpunt bewys $\therefore TE = 4$ cm	$\checkmark$ S/R $\checkmark$ R $\checkmark TE = 4$	(3)
10.3.3 (a)	$\frac{\text{Area of } \triangle ADC}{\text{Area of } \triangle ABD}$ $= \frac{\frac{1}{2} \times b_1 \times h}{\frac{1}{2} \times b_2 \times h}$ same height/selfde hoogte $= \frac{3y}{2y}$ $= \frac{3}{2}$	$\checkmark \checkmark$ S/R $\checkmark \frac{3}{2}$	(3)
(b)	$\frac{\frac{1}{2} \times TC \times EC \times \sin C}{\frac{1}{2} \times AC \times BC \times \sin C}$ $= \frac{(x)(y)}{(3x)(5y)}$ $= \frac{1}{15}$	$\checkmark \checkmark \frac{\frac{1}{2} \times TC \times EC \times \sin C}{\frac{1}{2} \times AC \times BC \times \sin C}$ $\checkmark \frac{1}{15}$	(3)
			[19]

QUESTION/VRAAG 11

11.1	In $\triangle TPS$ and $\triangle QSR$ $\frac{PS}{QS} = \frac{1,5}{4} = \frac{3}{8}$ $\frac{TP}{SR} = \frac{4,5}{12} = \frac{3}{8}$ $\frac{TS}{QR} = \frac{3,6}{9,6} = \frac{3}{8}$ $\therefore \triangle TPS \sim \triangle QSR$ sides of triangles in proportion <i>sy van die driehoeke is in verhouding</i> $\therefore \hat{PTS} = \hat{R}$ $\therefore TP$ is a tangent converse of tan chord theorem/ <i>is 'n raaklyn teenoorg. van tan koordstelling</i>	$\checkmark \frac{PS}{QS} = \frac{1,5}{4}$ $\checkmark \frac{TP}{SR} = \frac{4,5}{12}$ $\checkmark \frac{TS}{QR} = \frac{3,6}{9,6}$ $\checkmark \checkmark S/R$ $\checkmark \hat{PTS} = \hat{R}$ $\checkmark R$ (7)
11.2	$\hat{P} = \hat{QSR}$ $\triangle s \sim$ $QS \parallel TP$ corr angles =/korr hoeke $\frac{TQ}{9,6} = \frac{1,5}{12}$ proportional theorem/verhoudingstelling $\therefore TQ = 1,2$	$\checkmark S$ $\checkmark R$ $\checkmark \checkmark S/R$ $\checkmark TQ = 1,2$ (5)
		[12]

TOTAL/TOTAAL: 150