



education

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NORTH WEST PROVINCE

PROVINCIAL ASSESSMENT TASK

GRADE 12

INVESTIGATION

15 – 19 MARCH 2021

MARKS: 100

TIME: 3 hours

This task consists of 12 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

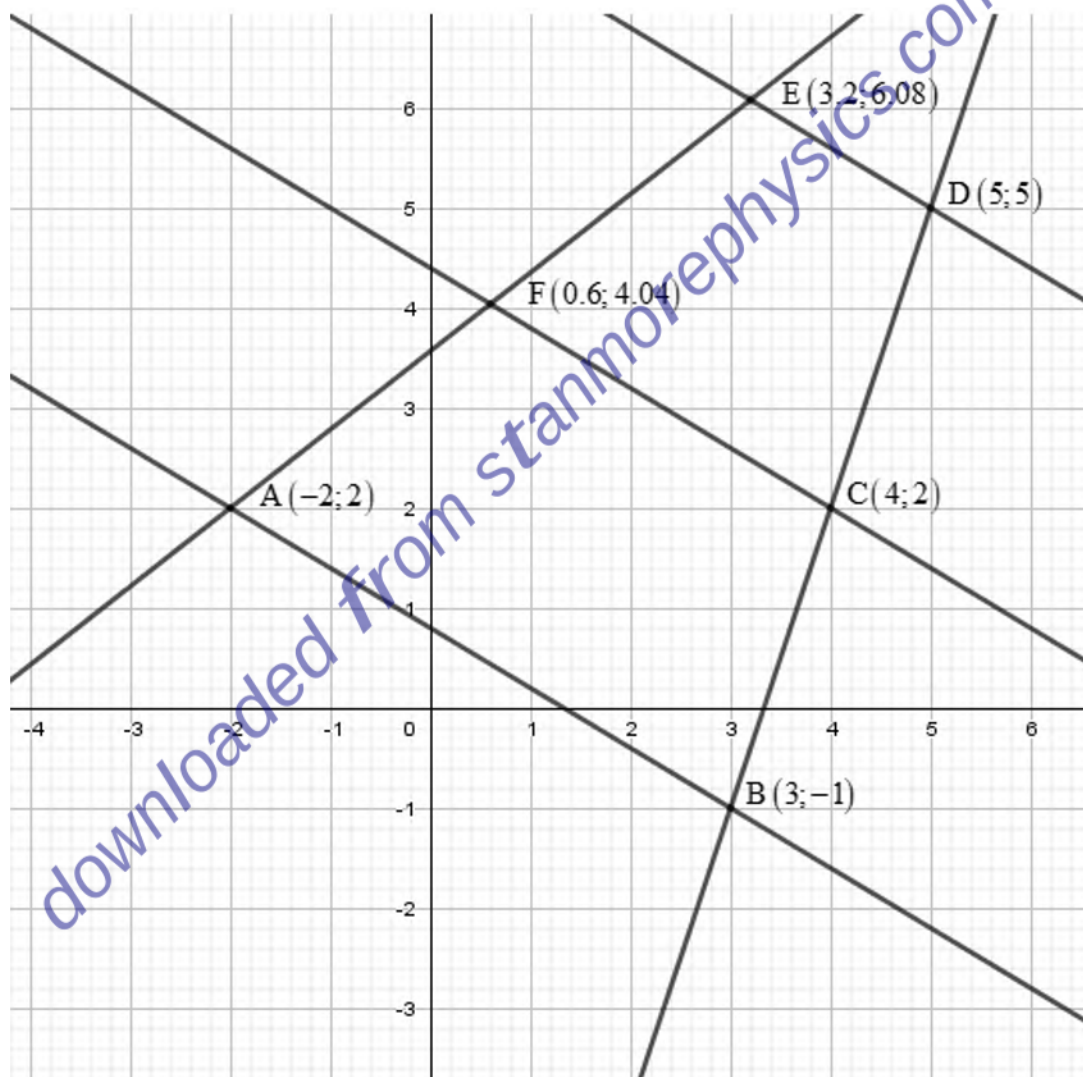
1. This task consists of 6 questions.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper
4. Clearly show ALL calculations, diagrams, graphs, et cetera which you have used in determining your answers.
5. Answers only will not necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. Write neatly and legibly.

INVESTIGATING HOW A LINE INTERSECTING TWO SIDES OF A TRIANGLE DIVIDES THESE TWO SIDES.

QUESTION 1

1.1 What is a ratio? (2)

1.2 In the diagram below are three line segments AB, CF and DE. BD and AE are two transversal lines. The coordinates of the points are A(-2;2), B(3;-1), C(4;2), D(5;5), E(3.2;6.08) and F(0.6;4.04).



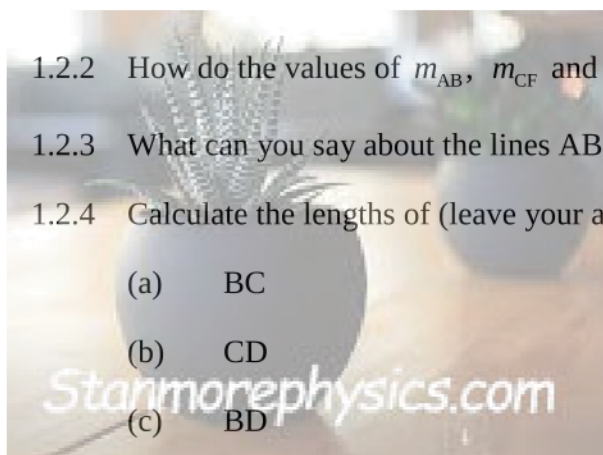
1.2.1 Calculate the gradient of:

(a) AB (2)

(b) CF (1)

(c) DE (1)

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1.2.2 How do the values of m_{AB} , m_{CF} and m_{DE} compare? (1)

1.2.3 What can you say about the lines AB, CF and DE? (1)

1.2.4 Calculate the lengths of (leave your answer in surd form where possible):

(a) BC (2)

(b) CD (1)

(c) BD (1)

(d) EF (correct to TWO decimal places) (1)

(e) AF (correct to TWO decimal places) (1)

(f) AE (1)

1.2.5 What is a mathematical proportion? (2)

1.2.6 Determine and compare the ratios:

(a) $\frac{BC}{CD}$ and $\frac{AF}{EF}$ (3)

(b) $\frac{BC}{BD}$ and $\frac{AF}{AE}$ (3)

(c) $\frac{CD}{DB}$ and $\frac{EF}{AE}$ (3)

1.2.7 Complete the following conjecture:

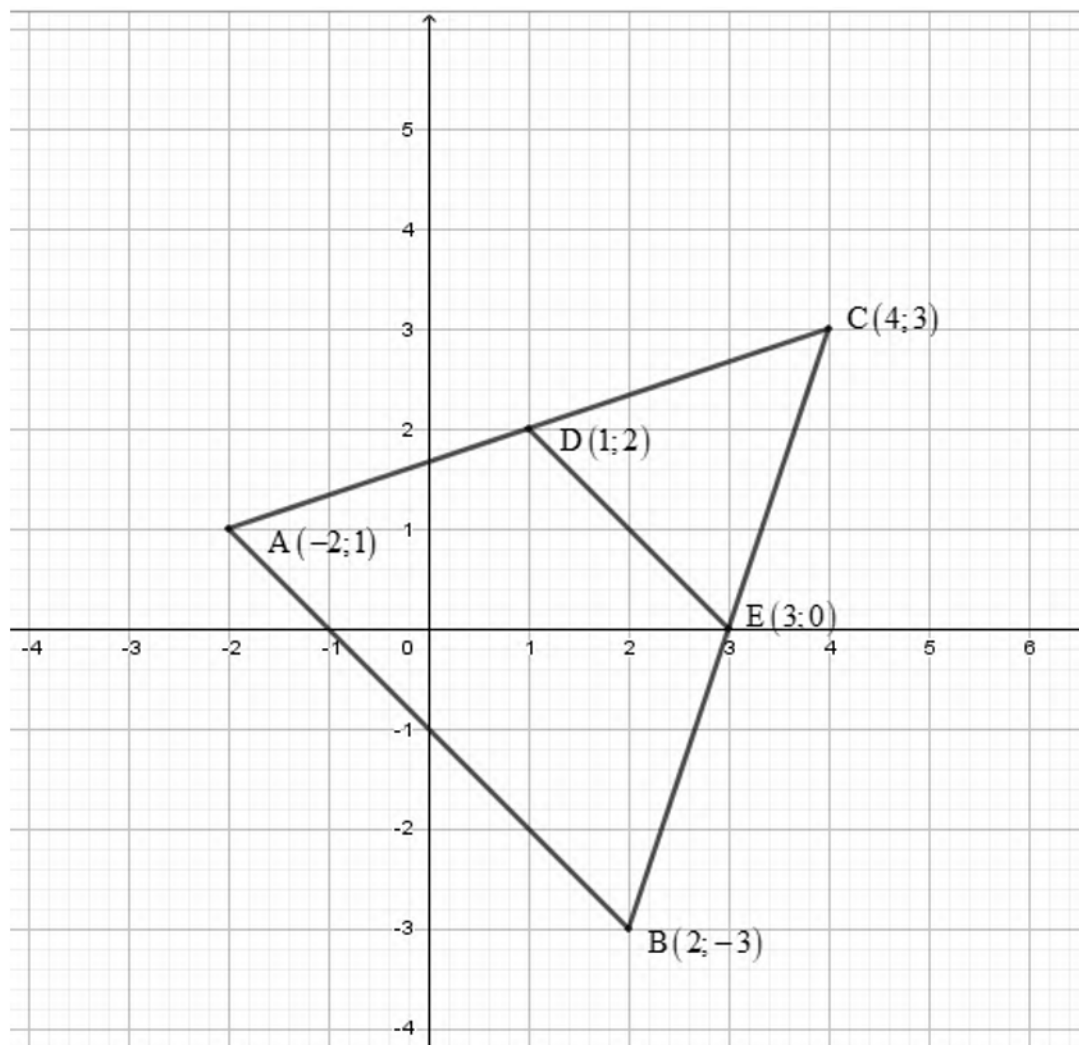
If three lines intersect two transversals, then the lines divide the transversals (2)

[28]

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QUESTION 2

In the sketch below the coordinates of the vertices of $\triangle ABC$ are $A(-2;1)$, $B(2;-3)$ and $C(4;3)$. $D(1;2)$ is on AC and $E(3;0)$ on BC .



2.1 Calculate the gradient of:

2.1.1 AB (1)

2.1.2 DE (1)

2.2 Compare the gradients m_{AB} and m_{DE} . (1)

2.3 What can you say about the line segments AB and DE? (1)

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2.4 Calculate the length of (leave your answer in surd form):

2.4.1 BE (1)

2.4.2 CE (1)

2.4.3 BC (1)

2.4.4 AD (1)

2.4.5 CD (1)

2.4.6 AC (1)

2.5 Determine and compare the ratios:

2.5.1 $\frac{BE}{EC}$ and $\frac{AD}{DC}$ (3)

2.5.2 $\frac{BE}{BC}$ and $\frac{AD}{AC}$ (3)

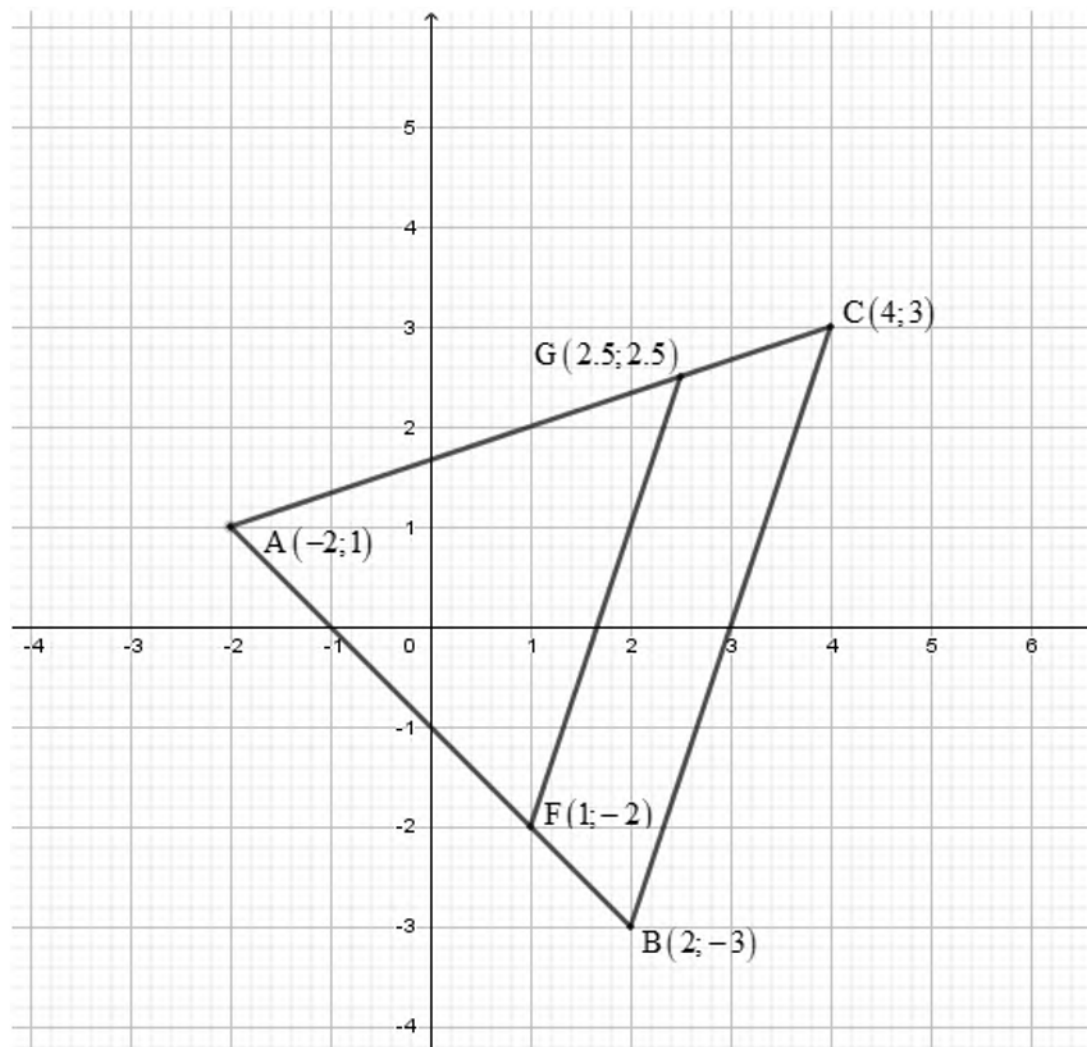
2.5.3 $\frac{CE}{BC}$ and $\frac{CD}{AC}$ (3)

[19]

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QUESTION 3

In the sketch below the coordinates of the vertices of $\triangle ABC$ are $A(-2;1)$, $B(2;-3)$ and $C(4;3)$. $F(1;-2)$ is on AB and $G(2.5;2.5)$ on AC .



- 3.1 Calculate the gradient of:
- 3.1.1 BC (1)
- 3.1.2 FG (1)
- 3.2 How do gradients m_{BC} and m_{FG} compare? (1)
- 3.3 What can you say about the line segments BC and FG ? (1)

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3.4 Calculate the length of (leave your answer in surd form):

3.4.1 AF (1)

3.4.2 FB (1)

3.4.3 AB (1)

3.4.4 AG (1)

3.4.5 CG (1)

3.5 Determine and compare the ratios:

3.5.1 $\frac{FB}{AF}$ and $\frac{GC}{AG}$ (3)

3.5.2 $\frac{FB}{AB}$ and $\frac{CG}{AC}$ (3)

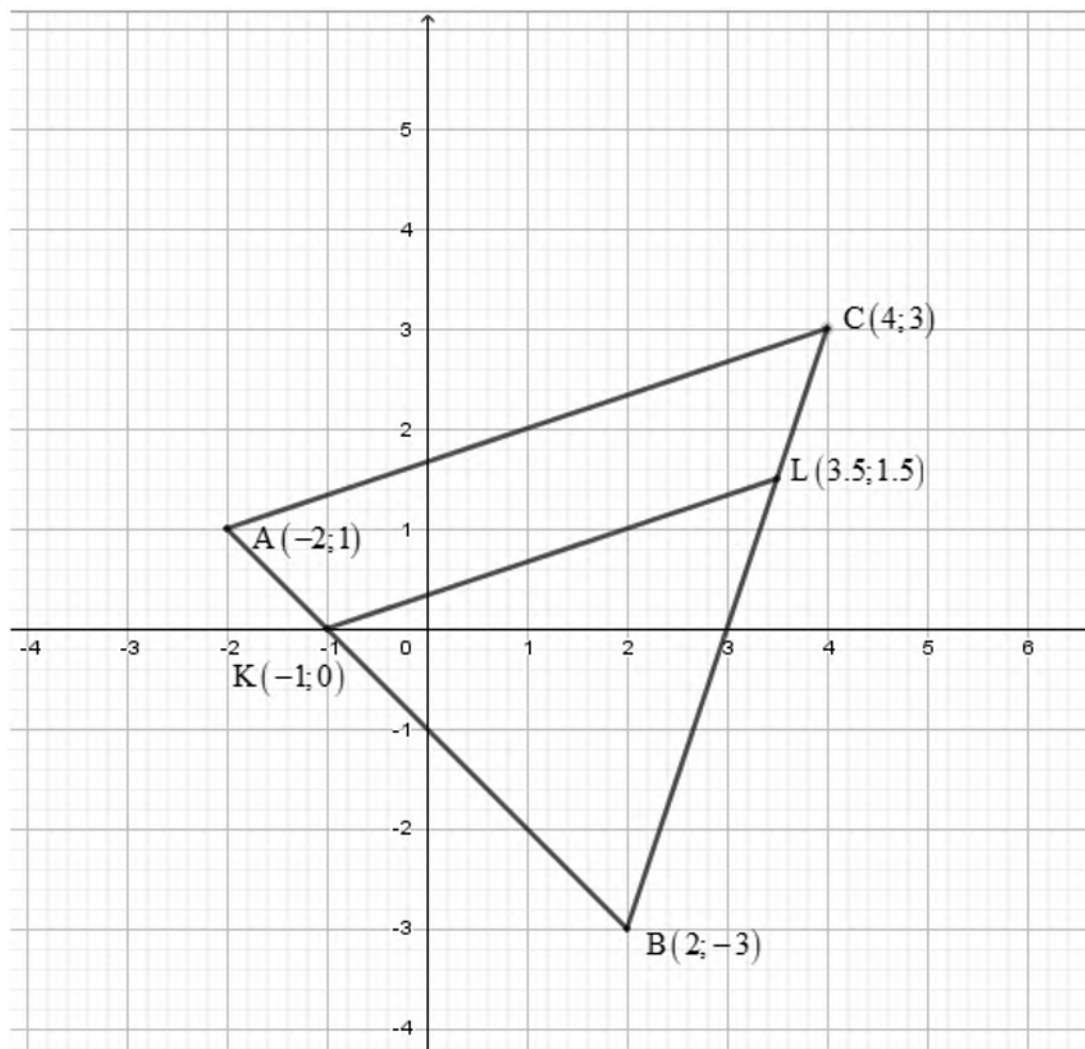
3.5.3 $\frac{AF}{AB}$ and $\frac{AG}{AC}$ (3)

[18]

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QUESTION 4

In the sketch below the coordinates of the vertices of $\triangle ABC$ are $A(-2;1)$, $B(2;-3)$ and $C(4;3)$. $K(-1;0)$ is on AB and $L(3.5;1.5)$ on BC .



- 4.1 Calculate the gradient of
 - 4.1.1 AC (1)
 - 4.1.2 KL (1)
- 4.2 Compare the gradients m_{AC} and m_{KL} . (1)
- 4.3 What can you say about the line segments AC and KL? (1)

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4.4 Calculate the length of (leave your answer in surd form):

4.4.1 AK (1)

4.4.2 KB (1)

4.4.3 CL (1)

4.4.4 LB (1)

4.5 Determine and compare the ratios:

4.5.1 $\frac{AK}{KB}$ and $\frac{CL}{LB}$ (3)

4.5.2 $\frac{AK}{AB}$ and $\frac{CL}{BC}$ (3)

4.5.3 $\frac{KB}{AB}$ and $\frac{LB}{BC}$ (3)

[17]

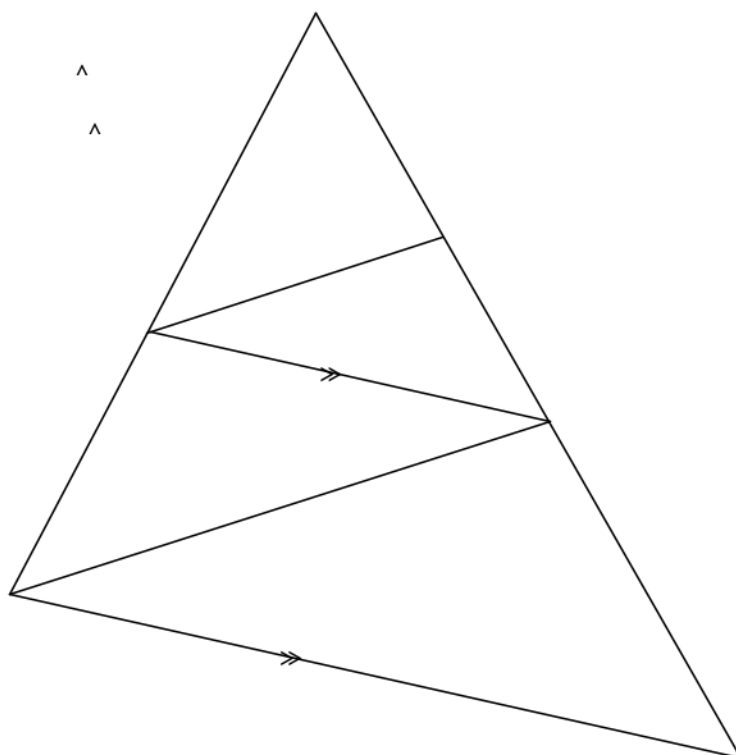
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QUESTION 5

5.1 From questions 2, 3 and 4 above we can conclude that:

If a line intersecting a triangle is to one side of the triangle, then the line divides the other two sides (2)

5.2 In the diagram below $SU \parallel QT$ and $ST \parallel QR$.
 $PU = 9\text{cm}$ and $UT = 6\text{cm}$



Giving reasons

5.2.1 Calculate $\frac{PS}{SQ}$ (2)

5.2.2 Calculate TR (2)

[6]

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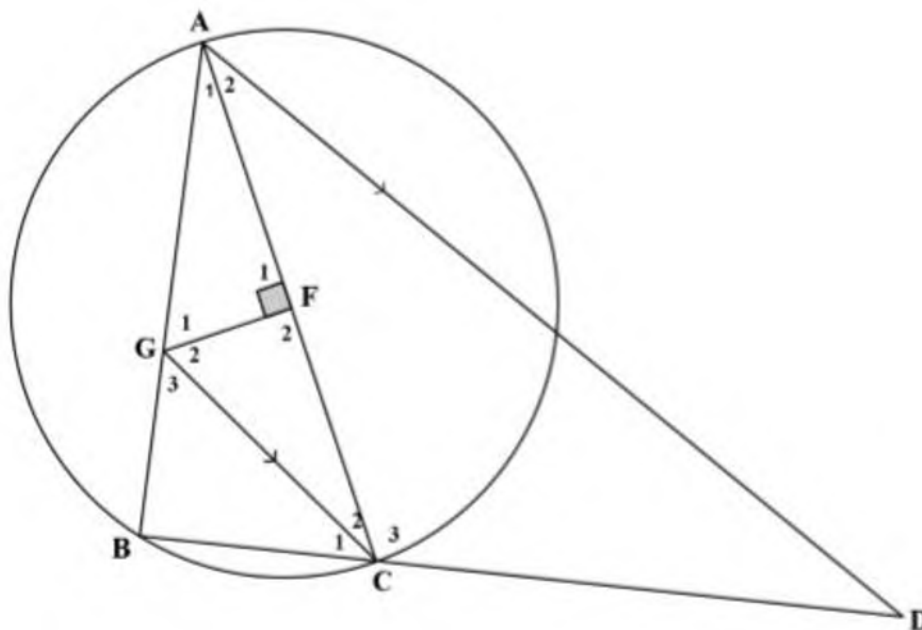
QUESTION 6

AC is a diameter of the circle with centre F.

$$\angle C_1 = \angle C_2$$

GF is perpendicular to AC.

AD $\parallel$ GC



Prove that:

6.1 $AC = CD$ (3)

6.2 $\frac{BC}{AC} = \frac{BG}{GA}$ (2)

6.3 GBCF is a cyclic quadrilateral. (3)

6.4 If $BC = 12$ units and the radius of the circle is 10 units,

6.4.1 determine the length of AB (2)

6.4.2 determine the length of GA. (2)

[12]

TOTAL: [100]



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**PROVINSIALE
ASSESSERINGSTAAK**

GRAAD 12

ONDERSOEK: MEMO

15 – 19 MAART 2021

PUNTE: 100

Hierdie merkriglyne bestaan uit 16 bladsye.

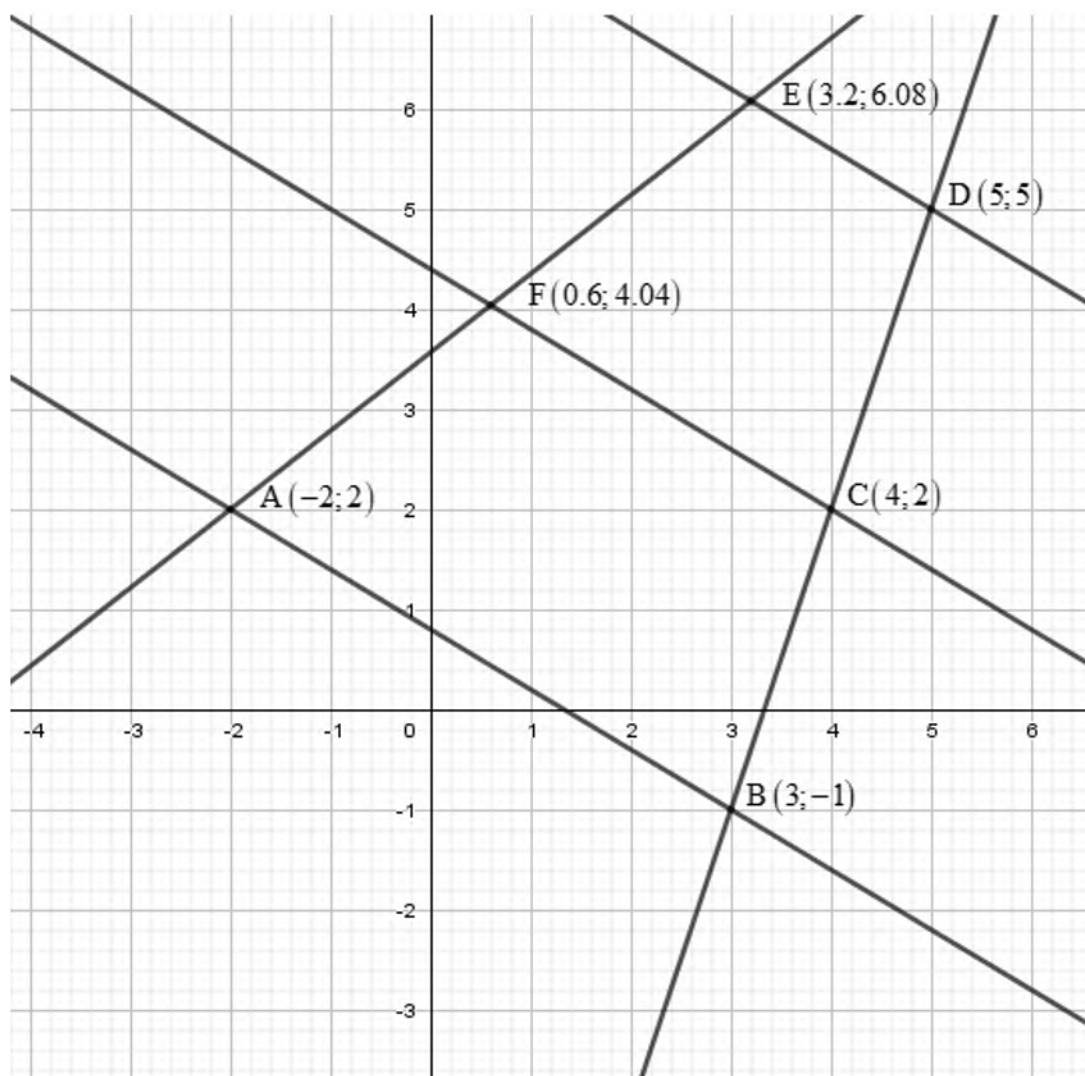
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ONDERSOEK HOE 'N LYN WAT TWEE SYE VAN 'N DRIEHOEK SNY, DIE SYE VERDEEL.

VRAAG 1

1.1	Verhouding: Vergelyking van twee hoeveelhede deur deling	✓ twee hoeveelhede ✓ deling	(2)

1.2



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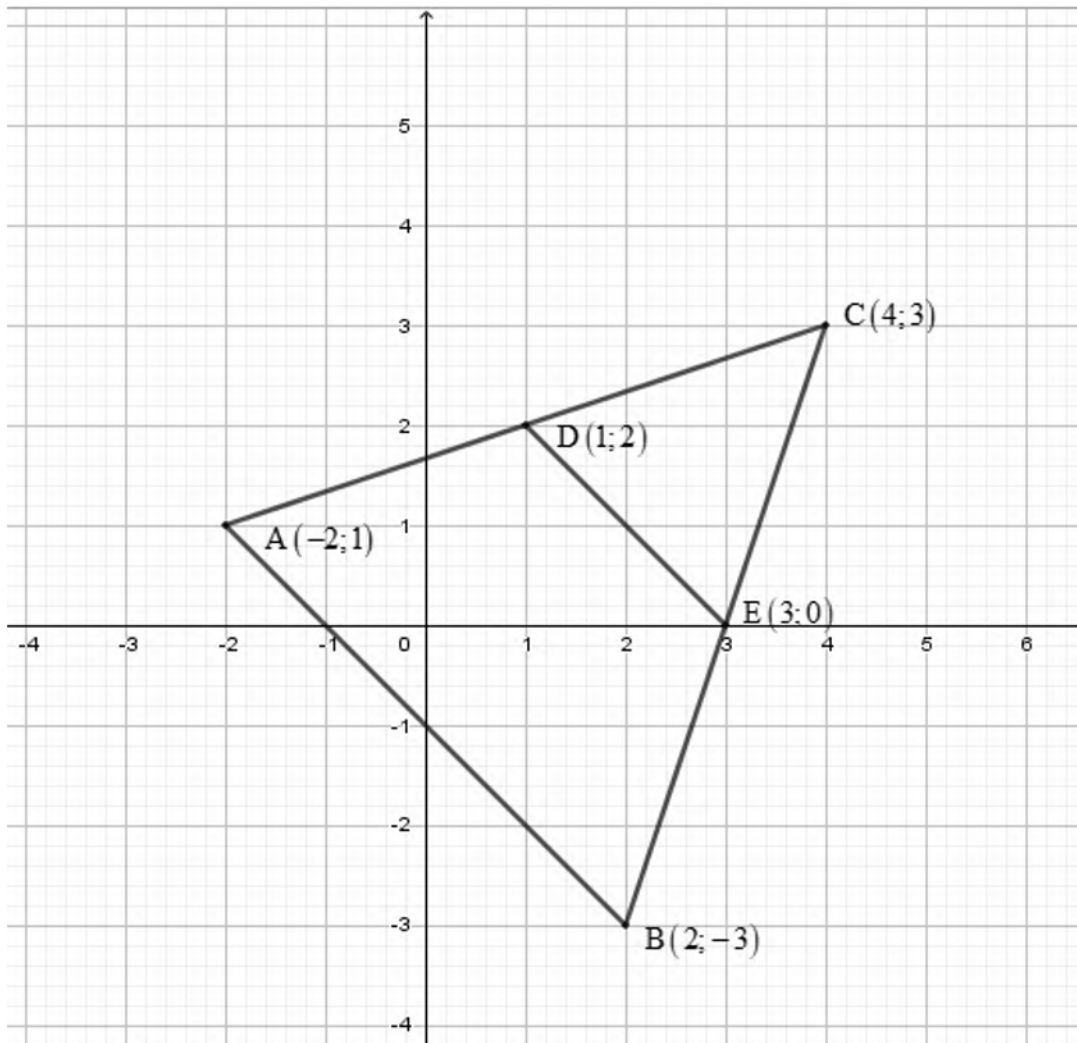
1.2.1 (a)	$m_{AB} = \frac{-1-2}{3+2}$ $= -\frac{3}{5}$	✓ substitusie ✓ $-\frac{3}{5}$ or $-0,6$	(2)
(b)	$m_{CF} = \frac{2-4,04}{4-0,6}$ $= -\frac{3}{5}$	✓ $-\frac{3}{5}$ or $-0,6$	(1)
(c)	$m_{DE} = \frac{5-6,08}{5-3,2}$ $= -\frac{3}{5}$	✓ $-\frac{3}{5}$ or $-0,6$	(1)
1.2.2	$m_{AB} = m_{CF} = m_{DE}$	✓ antwoord	(1)
1.2.3	$AB \parallel CF \parallel DE$	✓ antwoord	(1)
1.2.4 (a)	$BC = \sqrt{(4-3)^2 + (2+1)^2}$ $= \sqrt{10}$	✓ substitusie ✓ $\sqrt{10}$	(2)
(b)	$CD = \sqrt{(5-4)^2 + (5-2)^2}$ $= \sqrt{10}$	✓ $\sqrt{10}$	(1)
(c)	$BD = \sqrt{(5-3)^2 + (5+1)^2}$ $= 2\sqrt{10}$ OF $BD = BC + CD$ $= \sqrt{10} + \sqrt{10}$ $= 2\sqrt{10}$	✓ $2\sqrt{10}$ ✓ $2\sqrt{10}$	(1)
(d)	$EF = \sqrt{(3,2-0,6)^2 + (6,08-4,04)^2}$ $= 3,31$	✓ 3,31	(1)
(e)	$AF = \sqrt{(0,6+2)^2 + (4,04-2)^2}$ $= 3,31$	✓ 3,31	(1)

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(f)	$AE = AF + FE = 6,62$	✓ 6,62	(1)
1.2.5	Verhouding: Twee verhoudings wat gelyk is aan mekaar OF 'n Vergelyking wat toon dat dat twee verhoudings gelyk is	✓ twee verhoudings ✓ gelyk ✓ vergelyking ✓ twee verhoudings	(2)
1.2.6 (a)	$\frac{BC}{CD} = \frac{\sqrt{10}}{\sqrt{10}} = 1$ $\frac{AF}{EF} = \frac{3,31}{3,31} = 1$ $\frac{BC}{CD} = \frac{AF}{EF}$	✓ 1 ✓ 1 ✓ verhouding	(3)
(b)	$\frac{BC}{BD} = \frac{\sqrt{10}}{2\sqrt{10}} = \frac{1}{2}$ $\frac{AF}{AE} = \frac{3,31}{6,62} = \frac{1}{2}$ $\frac{BC}{BD} = \frac{AF}{AE}$	✓ $\frac{1}{2}$ ✓ $\frac{1}{2}$ ✓ verhouding	(3)
(c)	$\frac{CD}{DB} = \frac{\sqrt{10}}{2\sqrt{10}} = \frac{1}{2}$ $\frac{EF}{AE} = \frac{3,31}{6,62} = \frac{1}{2}$ $\frac{CD}{DB} = \frac{EF}{AE}$	✓ $\frac{1}{2}$ ✓ $\frac{1}{2}$ ✓ verhouding	(3)
1.2.7	Indien drie <u>parallele</u> lyne twee transversal sny, dan verdeel die lyne in <u>diesefde verhouding</u> / <u>eweredig</u>	✓ parallel ✓ dieselfde verhouding / eweredig	(2)
			[28]

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VRAAG 2



2.1.1	$m_{AB} = \frac{-3-1}{2+2} = -1$	✓ -1	(1)
2.1.2	$m_{DE} = \frac{0-2}{3-1} = -1$	✓ -1	(1)
2.2	$m_{AB} = m_{DE}$	✓ antwoord	(1)
2.3	AB DE	✓ antwoord	(1)
2.4.1	$BE = \sqrt{(3-2)^2 + (0+3)^2}$ $= \sqrt{10}$	✓ $\sqrt{10}$	(1)

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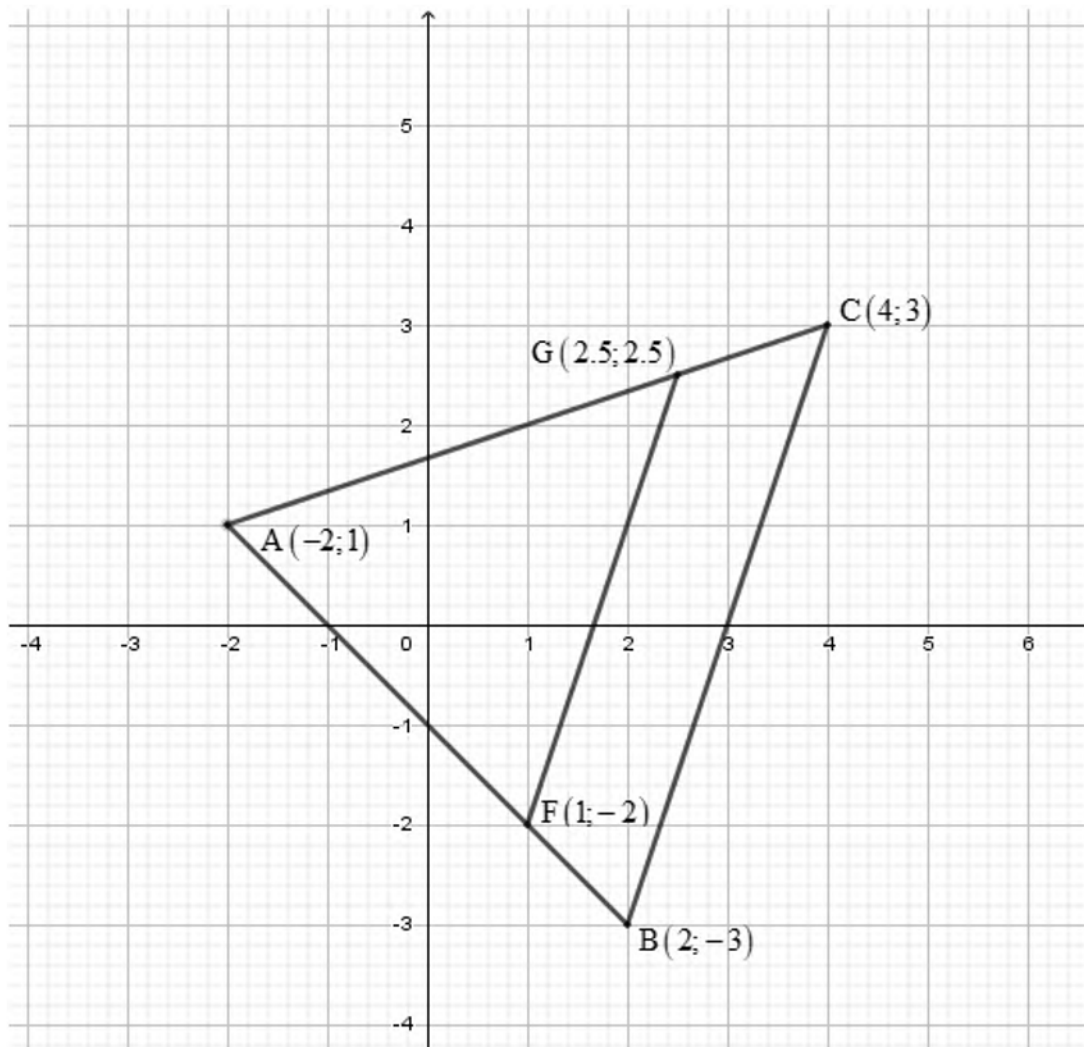
2.4.2	$CE = \sqrt{(4-3)^2 + (3-0)^2}$ $= \sqrt{10}$	✓ $\sqrt{10}$	(1)
2.4.3	$BC = 2\sqrt{10}$	✓ $2\sqrt{10}$	(1)
2.4.4	$AD = \sqrt{(1+2)^2 + (2-1)^2}$ $= \sqrt{10}$	✓ $\sqrt{10}$	(1)
2.4.5	$CD = \sqrt{(4-1)^2 + (3-2)^2}$ $= \sqrt{10}$	✓ $\sqrt{10}$	(1)
2.4.6	$AC = 2\sqrt{10}$	✓ $2\sqrt{10}$	(1)
2.5.1	$\frac{BE}{EC} = \frac{\sqrt{10}}{\sqrt{10}} = 1$ $\frac{AD}{DC} = \frac{\sqrt{10}}{\sqrt{10}} = 1$ $\frac{BE}{EC} = \frac{AD}{DC}$	✓ 1 ✓ 1 ✓ verhouding	(3)
2.5.2	$\frac{BE}{BC} = \frac{\sqrt{10}}{2\sqrt{10}} = \frac{1}{2}$ $\frac{AD}{AC} = \frac{\sqrt{10}}{2\sqrt{10}} = \frac{1}{2}$ $\frac{BE}{BC} = \frac{AD}{AC}$	✓ $\frac{1}{2}$ ✓ $\frac{1}{2}$ ✓ verhouding	(3)

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2.5.3	$\frac{CE}{BC} = \frac{\sqrt{10}}{2\sqrt{10}} = \frac{1}{2}$ $\frac{CD}{AC} = \frac{\sqrt{10}}{2\sqrt{10}} = \frac{1}{2}$ $\frac{CE}{BC} = \frac{CD}{AC}$	$\checkmark \frac{1}{2}$ $\checkmark \frac{1}{2}$ $\checkmark$ verhouding	(3)
			[19]

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VRAAG 3



3.1.1	$m_{BC} = \frac{3+3}{4-2} = 3$	✓ 3	(1)
3.1.2	$m_{FG} = \frac{2,5+2}{2,5-1} = 3$	✓ 3	(1)
3.2	$m_{BC} = m_{FG}$	✓ antwoord	(1)
3.3	BC ∥ FG	✓ antwoord	(1)
3.4.1	$AF = \sqrt{(1+2)^2 + (-2-1)^2}$ $= 3\sqrt{2}$	✓ $3\sqrt{2}$	(1)

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3.4.2	$FB = \sqrt{(2-1)^2 + (-3+2)^2}$ $= \sqrt{2}$	✓ $\sqrt{2}$	(1)
3.4.3	$AB = 3\sqrt{2} + \sqrt{2}$ $= 4\sqrt{2}$	✓ $4\sqrt{2}$	(1)
3.4.4	$AG = \sqrt{(2,5+2)^2 + (2,5-1)^2}$ $= \frac{3\sqrt{10}}{2}$	✓ $\frac{3\sqrt{10}}{2}$	(1)
3.4.5	$CG = \sqrt{(3-2,5)^2 + (4-2,5)^2}$ $= \frac{\sqrt{10}}{2}$	✓ $\frac{\sqrt{10}}{2}$	(1)
3.5.1	$\frac{FB}{AF} = \frac{\sqrt{2}}{3\sqrt{2}} = \frac{1}{3}$ $\frac{GC}{AG} = \frac{\frac{\sqrt{10}}{2}}{\frac{3\sqrt{10}}{2}} = \frac{\sqrt{10}}{2} \times \frac{2}{3\sqrt{10}} = \frac{1}{3}$ $\frac{FB}{AF} = \frac{GC}{AG}$	 ✓ $\frac{1}{3}$ ✓ $\frac{1}{3}$ ✓ verhouding	(3)
3.5.2	$\frac{FB}{AB} = \frac{\sqrt{2}}{4\sqrt{2}} = \frac{1}{4}$ $\frac{CG}{AC} = \frac{\frac{\sqrt{10}}{2}}{2\sqrt{10}} = \frac{\sqrt{10}}{2} \times \frac{1}{2\sqrt{10}} = \frac{1}{4}$ $\frac{FB}{AB} = \frac{CG}{AC}$	 ✓ $\frac{1}{4}$ ✓ $\frac{1}{4}$ ✓ verhouding	(3)

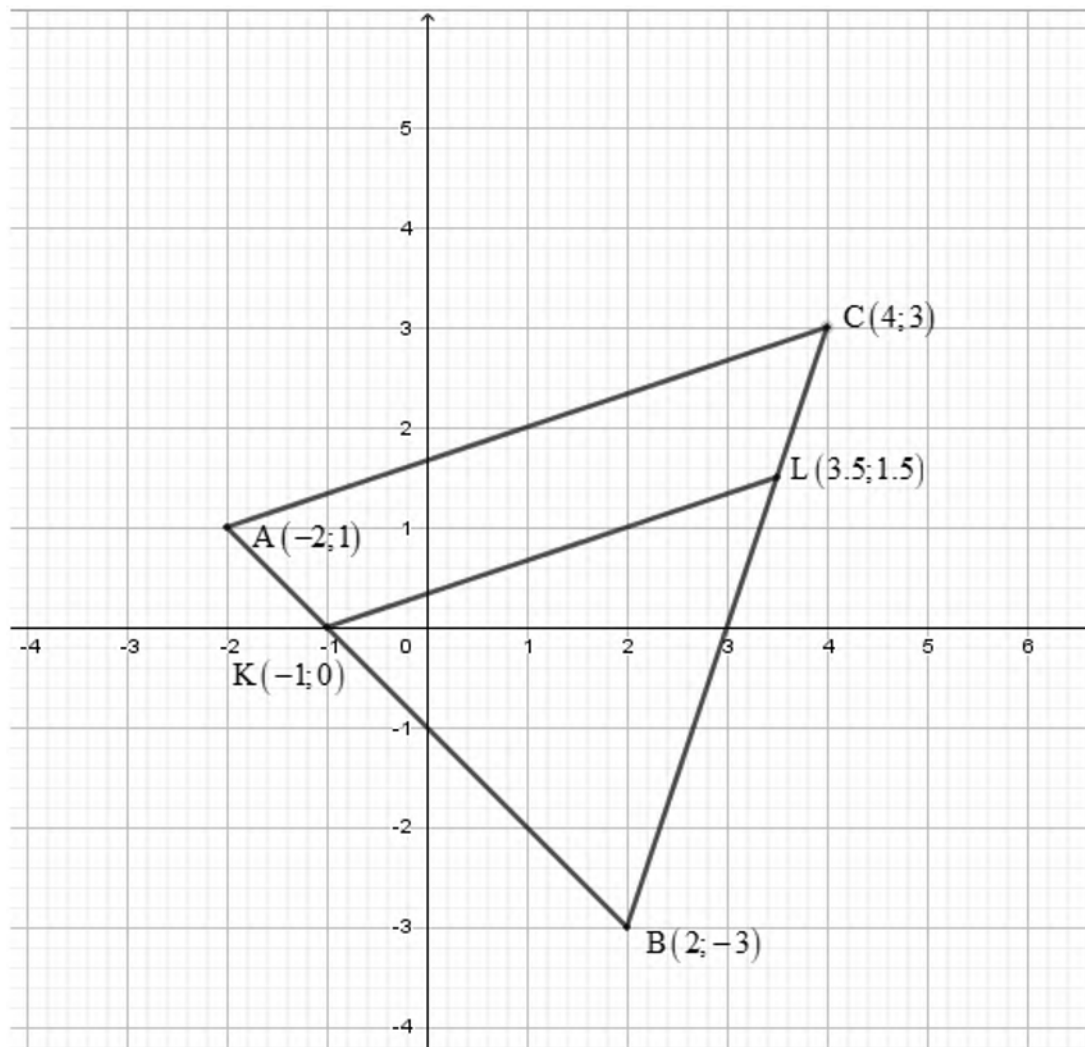
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3.5.3	$\frac{AF}{AB} = \frac{3\sqrt{2}}{4\sqrt{2}} = \frac{3}{4}$ $\frac{AG}{AC} = \frac{\frac{3\sqrt{10}}{2}}{2\sqrt{10}} = \frac{3\sqrt{10}}{2} \times \frac{1}{2\sqrt{10}} = \frac{3}{4}$ $\frac{AF}{AB} = \frac{AG}{AC}$	$\checkmark \frac{3}{4}$ $\checkmark \frac{3}{4}$ $\checkmark$ verhouding	(3)
			[18]

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VRAAG 4

In die skets hieronder is die koördinate van die hoekpunte van $\triangle ABC$, $A(-2;1)$, $B(2;-3)$ en $C(4;3)$. $K(-1;0)$ lê op AB en $L(3.5;1.5)$ op BC .



4.1.1	$m_{AC} = \frac{3-1}{4-(-2)} = \frac{1}{3}$	✓ $\frac{1}{3}$	(1)
4.1.2	$m_{KL} = \frac{1.5-0}{3.5-(-1)} = \frac{1}{3}$	✓ $\frac{1}{3}$	(1)
4.2	$m_{AC} = m_{KL}$	✓ antwoord	(1)
4.3	$AC \parallel KL$	✓ antwoord	(1)

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4.4.1	$AK = \sqrt{(-1+2)^2 + (0-1)^2}$ $= \sqrt{2}$	✓ $\sqrt{2}$	(1)
4.4.2	$KB = \sqrt{(2+1)^2 + (-3-0)^2}$ $= 3\sqrt{2}$	✓ $3\sqrt{2}$	(1)
4.4.3	$CL = \sqrt{(4-3)^2 + (3-1,5)^2}$ $= \frac{\sqrt{10}}{2}$	✓ $\frac{\sqrt{10}}{2}$	(1)
4.4.4	$LB = \sqrt{(3,5-2)^2 + (1,5+3)^2}$ $= \frac{3\sqrt{10}}{2}$	✓ $\frac{3\sqrt{10}}{2}$	(1)
4.5.1	$\frac{AK}{KB} = \frac{\sqrt{2}}{3\sqrt{2}} = \frac{1}{3}$ $\frac{CL}{LB} = \frac{\frac{\sqrt{10}}{2}}{\frac{3\sqrt{10}}{2}} = \frac{\sqrt{10}}{2} \times \frac{2}{3\sqrt{10}} = \frac{1}{3}$ $\frac{AK}{KB} = \frac{CL}{LB}$	✓ $\frac{1}{3}$ ✓ $\frac{1}{3}$ ✓ verhouding	(3)
4.5.2	$\frac{AK}{AB} = \frac{\sqrt{2}}{4\sqrt{2}} = \frac{1}{4}$ $\frac{CL}{BC} = \frac{\frac{\sqrt{10}}{2}}{2\sqrt{10}} = \frac{\sqrt{10}}{2} \times \frac{1}{2\sqrt{10}} = \frac{1}{4}$ $\frac{AK}{AB} = \frac{CL}{BC}$	✓ $\frac{1}{4}$ ✓ $\frac{1}{4}$ ✓ verhouding	(3)

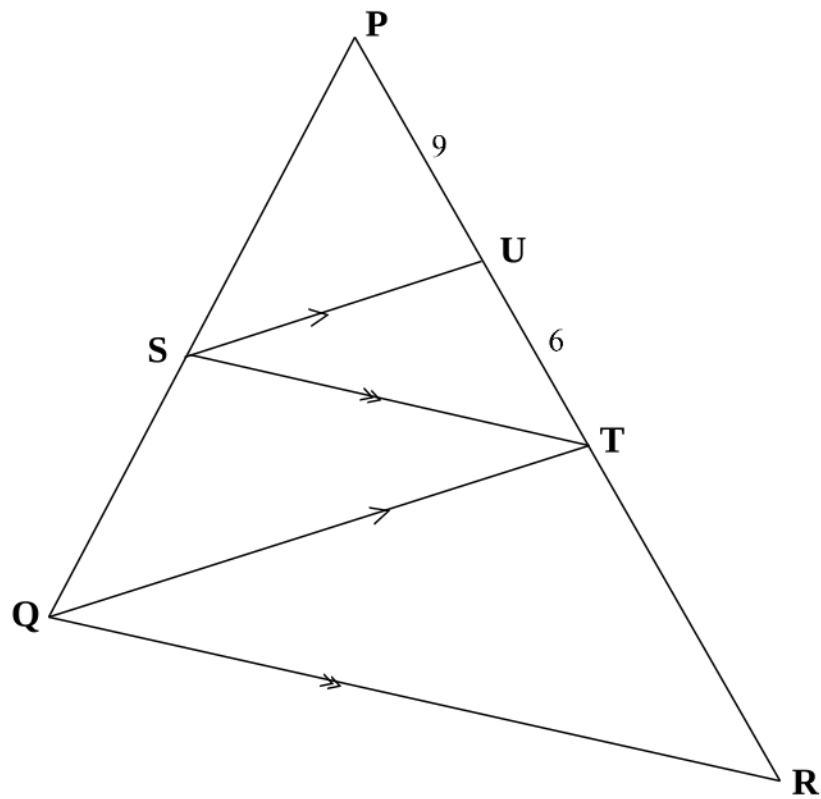
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4.5.3	$\frac{KB}{AB} = \frac{3\sqrt{2}}{4\sqrt{2}} = \frac{3}{4}$ $\frac{LB}{BC} = \frac{\frac{3\sqrt{10}}{2}}{2\sqrt{10}} = \frac{3\sqrt{10}}{2} \times \frac{1}{2\sqrt{10}} = \frac{3}{4}$ $\frac{KB}{AB} = \frac{LB}{BC}$	$\checkmark \frac{3}{4}$ $\checkmark \frac{3}{4}$ $\checkmark$ verhouding	(3)
			[17]

VRAAG 5

5.1	Indien 'n lyn wat 'n driehoek sny <u>parallel</u> is aan een sy van die driehoek, dan verdeel die lyn die ander twee sye van die driehoek <u>in dieselfde verhouding</u> / eweredig	$\checkmark$ parallel $\checkmark$ in dieselfde verhouding / eweredig	(2)
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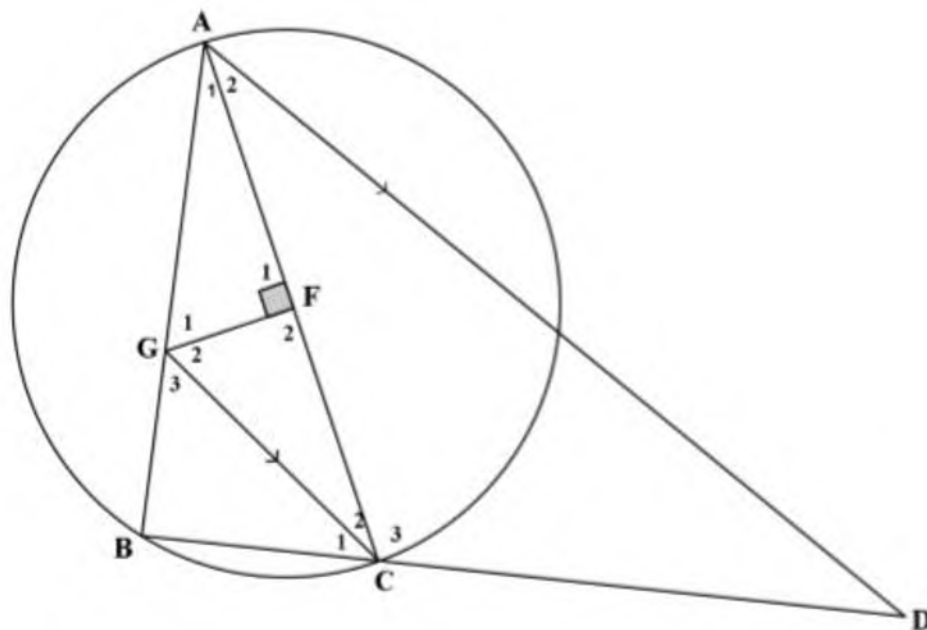
5.2



5.2.1	$\frac{PS}{SQ} = \frac{PU}{UT}$ [eweredigheidstelling; $SU \parallel QT$] OF [lyn $\parallel$ een sy van Δ] $\frac{PS}{SQ} = \frac{9}{6} = \frac{3}{2}$	$\checkmark$ S/ R $\checkmark$ antwoord	(2)
5.2.2	$\frac{TR}{PT} = \frac{SQ}{PS}$ [eweredigheidstelling; $ST \parallel QR$] OR [lyn $\parallel$ een sy van Δ] $\frac{TR}{15} = \frac{2}{3}$ $TR = \frac{2}{3} \times 15 = 10 \text{ cm}$	$\checkmark$ S/ R $\checkmark$ antwoord	(2)
			[6]

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VRAAG 6



6.1	$\angle C_1 = \angle D$ [ooreen. $\angle$ s; AD // GC] $\angle C_2 = \angle A_2$ [verw $\angle$ s; AD // GC] AC = CD [sy teenoor gelyke $\angle$ s]	✓ S/ R ✓ S/ R ✓ R	(3)
6.2	$\frac{BC}{CD} = \frac{BG}{GA}$ [eweredigheidsstelling; AD // GC] $\frac{BC}{AC} = \frac{BG}{GA}$ [AC = CD; bewys]	✓ S/ R ✓ S/ R	(2)
6.3	$\angle B = 90^\circ$ [$\angle \frac{1}{2} \odot$] $\angle F_2 = 90^\circ$ [GF $\perp$ AC] GBCF is 'n koordevierhoek [omgekeerd teenoorst $\angle$ e koordevierhoek]	✓ S/ R ✓ S/ R ✓ R	(3)

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6.4.1	$AC = 2 \times 10 = 20$ [deursnee = 2 x radius] $AB^2 + 12^2 = 20^2$ [Pyth.] $AB = 16$ units	 ✓ S ✓ antwoord	(2)
6.4.2	$\frac{GA}{AB} = \frac{CD}{BD}$ [eweredigheidstelling; AD // GC] $\frac{GA}{16} = \frac{20}{32}$ $GA = 10$	 ✓ S/ R ✓ antwoord	(2)
			[12]
	TOTAAL:		[100]