



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

## SENIOR CERTIFICATE/ NATIONAL SENIOR CERTIFICATE

IBANGA 12

MATHEMATIKA P2

SEPTEMBER 2021(2)

AMANQAKU: 150

IXESHA: 3 iiyure

Eliphepha lemibuzo linamaphepha ayi15 kudibene nephepha eli1 lolwazi.



**IMIYALELO NOLWAZI**

Funda imiyalelo elandelayo ngocoselelo phambi kokuphendula imibuzo.

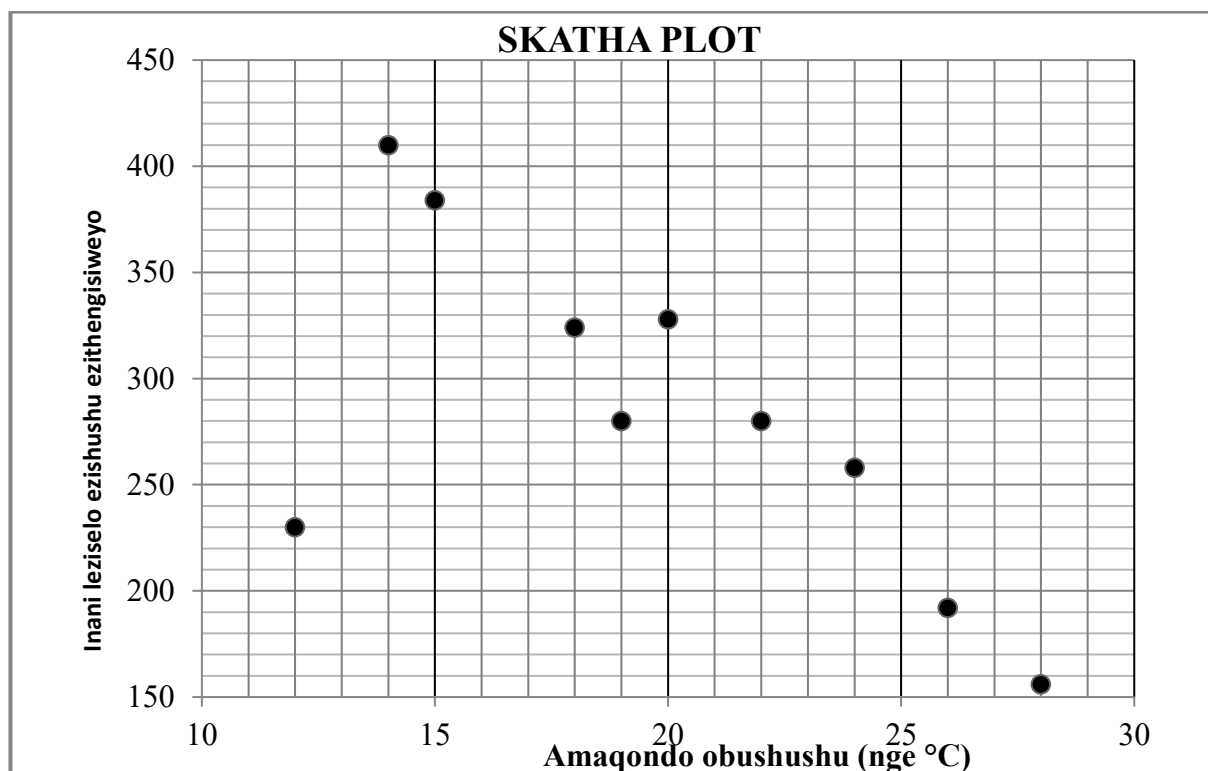
1. Eliphepha lemibuzo linemibuzo eyi 10.
2. Phendula YONKE imibuzo kwiNCWADI EKHETHIWEYO YOKUPHENDULELA enikiweyo.
3. Bonisa ngokucacileyo ZONKE iikhaltyhuleyshini, iidayagram, iigrafu, njl. ozisebenzisileyo ukubonisa iimpendulo zakho.
4. Iimpendulo kuphela azinyanzelekanga UKUNIKWA amanqaku apheleleyo.
5. Ungayisebenzisa ikhaltyhuleytha esayentifikhi evunyiweyo (engaprogranywanga nengenagrafikhi), ngaphandle kokuba uxelelwe ngeny'indlela.
6. Ukuba kunyanzelekile, sondeza iimpendulo kwiindawo EZIMBINI zedesimal, ngaphandle kokuba uxelelwe ngeny'indlela.
7. Iidayagram AZI zotywanga ngokwesikeyile (scale).
8. Iphepha lolwazi elineefomyula lifakiwe ekugqibeleni kwiphepha lemibuzo.
9. Bhala ngokucocekileyo nangokucacileyo.



**UMBUZO 1**

Umnyhadala wonyaka wezemidlalo ubanjwe iintsuku eziyi11. Ivenkile ithengisa iziselo ezishushu kulo mnyhadala. Ngosuku ngalunye kwiintsuku eziyi10 zokuqala, umnikazi wevenkile urekhode amaqondo obushushu ngo13:00 namanani eekomityi zesiselo esishushu ezithengisiweyo. Olu lwazi luboniswe kwithebhile nakwi skatha ploti esingezantsi.

<b>Amaqondo obushushu (nge °C)</b>	14	24	26	18	20	28	22	15	12	19
<b>Inani leziselo ezishushu ezithengisiweyo</b>	410	258	192	324	328	156	280	384	230	280

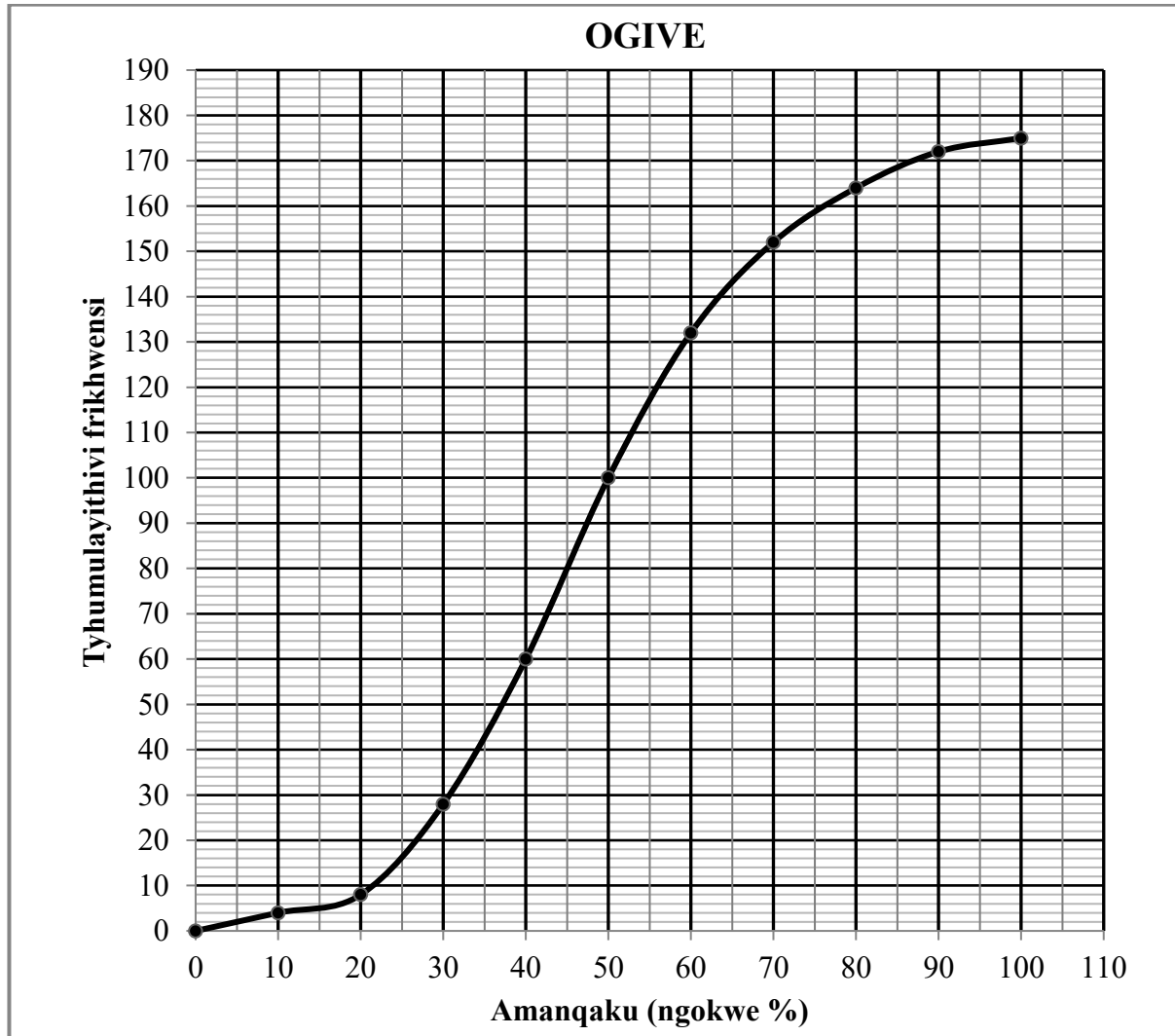


- 1.1 Chaza ithrend yedatha. (1)
  - 1.2 Fumana i-ikhweyzhini yezona zikwere zincinci zomgca werhigreshin zedatha. (3)
  - 1.3 Umnikazi uqaphele okokuba usebenzise ilitha enye yobisi kwiikomityi eziyi8 zeziselo ezishushu ezithengisiweyo. Ukuba amaqondo obushushu ngo13:00 kusuku lwe11 ebelindeleke ukuba abe ngu17 °C, qikelela inani lebhokisi ze1-litha yobisi umnikazi afanele ukuzithenga ndosuku lwe11 . (3)
  - 1.4 Chonga iawthlaya kwidatha. (1)
- [8]**



**UMBUZO 2**

2.1 Abafundi abasuka kwizikolo ezohlukileyo babhale uvavanyo olukhawulezileyo ukuze balungele ukufumana ibhasari. Amanqaku wabo (ngokwepesenti) aboniswe kwiogive (tyhumulethiv frikhwensi grafu) engezantsi.



- 2.1.1 Bangaphi abafundi ababhale uvavanyo? (1)
- 2.1.2 Bhala imodal klasi yedata. (1)
- 2.1.3 Iminimam makh ebalungeleyo ukufumana ibhasari ngu75%. Bangaphi abafundi abalungele ukufumana ibhasari? (2)



- 2.2 Itheybhile engezantsi ibonisa amanqaku wabafundi abayi15 abasuka kwisikolo esithile afumaneka kuvavanyo.

<b>Amanqaku (ngokwe%)</b>	62	58	78	85	74	48	74	84	100	46	80	92	60	90	92
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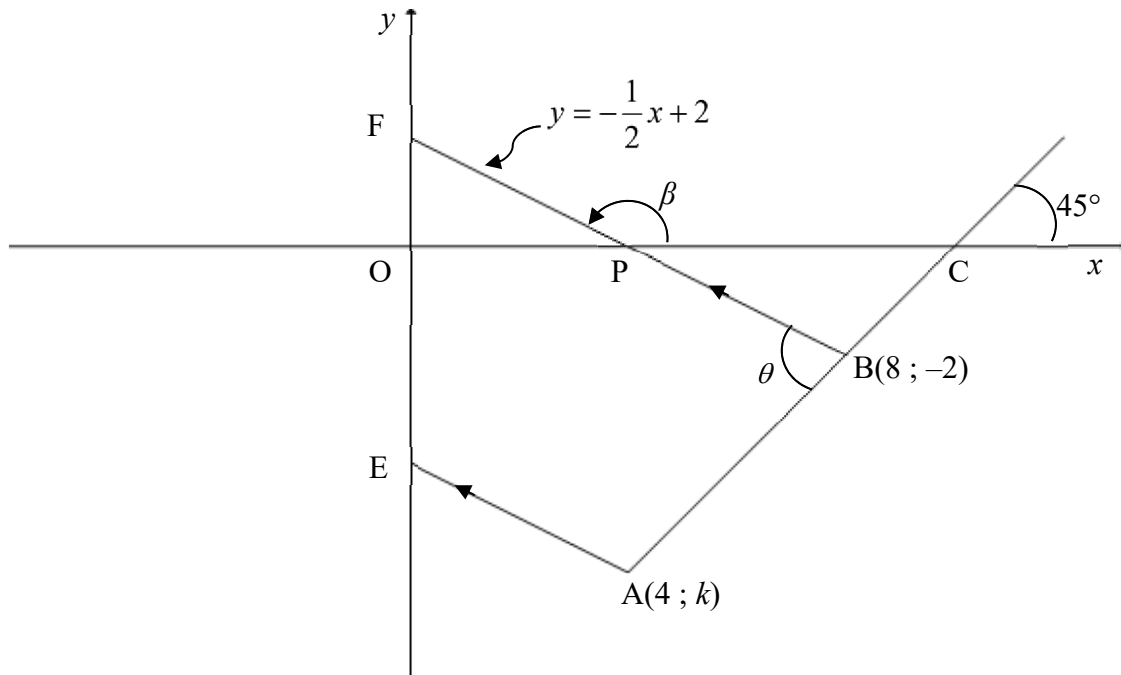
Khaltyhuleytha:

- 2.2.1 Imean mark efunyenwe ngabafundi (2)
- 2.2.2 IStandad deviyeyshin yamanqaku abafundi (1)
- 2.2.3 Amanani wabafundi abanamanqaku afumaneka ngaphezulu kwe standad deviyeyshin esinye ngaphezu kwe mean (2)
- 2.3 Amanqaku okugqibela webanga 11 (ngokwe pesenteyji) afunyenwe liqela labafundi elianalayziweyo. I-intavali yestandard deviyeyshin esinye nge mean ikhaltyhuleyhiwe njengo (82,7; 94,1).
- Khaltyhuleytha istandad deviyeyshin samanqaku okugqibela webanga 11. (3)  
**[12]**



**UMBUZO 3**

Kwidayagram engezantsi, umgca uBF uzotywe esuka ku  $B(8 ; -2)$  wanqumla i  $x$ -ekhziz ku P ne  $y$ - ekhziz ku F. Iinklineyshini ka BF ne  $\beta$  ne ikhweyzhin ka BF ngu  $y = -\frac{1}{2}x + 2$ . Ukusuka ku  $A(4 ; k)$ , omnye umgca uzotywe wapharalel ku BF waze wanqumla i  $y$ -ekhziz ku E. Umgca odlula ku A no B ine inklineyshin ka  $45^\circ$  ize inqumle i  $x$ -ekhziz ku C.  $\hat{A}BF = \theta$ .



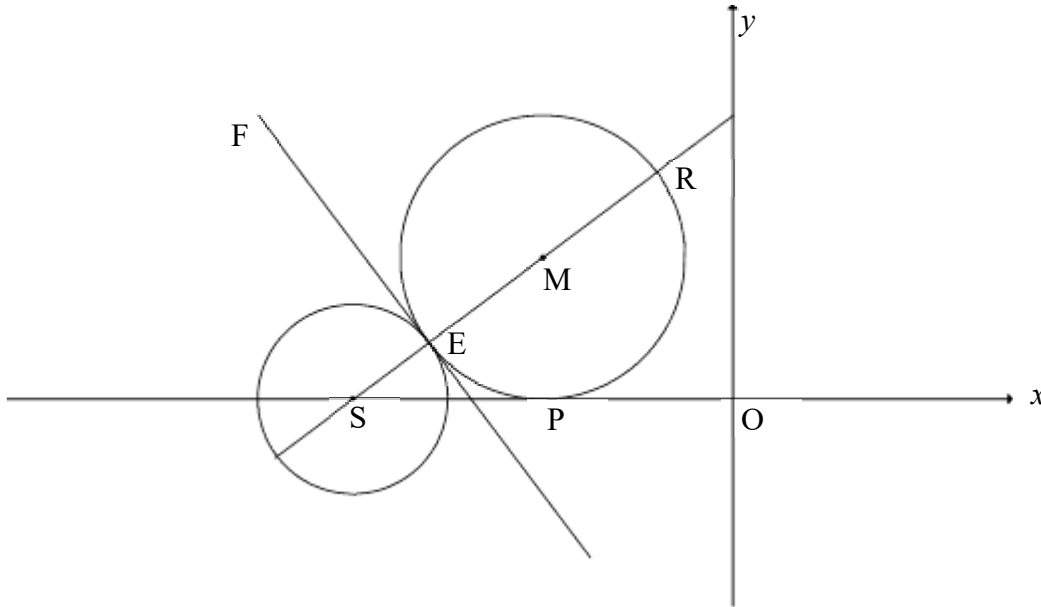
- 3.1 Khaltyhuleytha igradiyent kaAB. (1)
- 3.2 Bonisa ivelyu ka  $k$  ukuba ngu  $-6$ . (2)
- 3.3 Fumana i-ikhweyzhin ka EA ngokwefom  $y = mx + c$ . (3)
- 3.4 Khaltyhuleytha:
  - 3.4.1 Isayzi ka  $\theta$  (3)
  - 3.4.2 Ubude buka BF (3)
  - 3.4.3 Ieriya ka  $\Delta ABF$  (4)
- 3.5 Yenza G abe yipoynti kwi khwadrent yesine ukuze u APBG abe yipharalelogram. Khaltyhuleytha isayzi ka PAG. (4)

[20]



**UMBUZO 4**

Kwidayagram engezantsi, u S yipoynti kwi  $x$ -ekhziz. Isekile enombindi ku S ne sekile enombindi ku M zizotyawe. Zombini iisekile zingqubana ngaphandle ku E. FE yithanjenti ekhomon kwiisekile ku E. Isekile enombindi ku M, eno ER njengedayametha, ikwreca i  $x$ -ekhziz ku P.



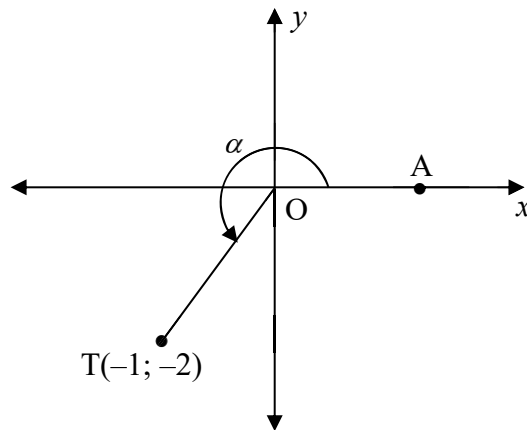
- 4.1 I-ikhweyzhin yesekile enombindi ku S ngu  $(x + 8)^2 + y^2 = 4$ .
  - 4.1.1 Bhala iikho-odineythi zika S. (2)
  - 4.1.2 Bonisa ukuba idayametha yesekile enombindi S ngu 4 yunithi. (1)
- 4.2 Kuphindiwe kwanikwa ukuba  $uSR = 8$  yunithi aze  $R\left(-\frac{8}{5}; \frac{24}{5}\right)$ , khaltyhuleytha:
  - 4.2.1 Ubude buka EM (2)
  - 4.2.2 Igradiyenti yethanjent FE (3)
  - 4.2.3 Iikho-odineythi zika M (4)
  - 4.2.4 Iikho-odineythi zika E (2)
- 4.3 Isekile enombindi ku  $M(-4; 3)$  ishiftiwe 1 yunithi ukuya ekhohlo ze yariflwekhthwa kwi  $x$ -ekhziz ukwenza isekile entsha enombindi ku K. Fumana ukuba ipoynti  $(-8; 0)$  ifumaneka ngaphakathi okanye ngaphandle isekile enombindi ku K. Bonisa ZONKE iikhaltyhuleyshin. (5)

[19]



**UMBUZO 5**

- 5.1 Ipoyinti  $T(-1; -2)$  inikiwe kwidayagram engezantsi. uA yipoyinti kwi  $x$ -ekhziz ukuze irifl ekh si  $\widehat{AOT} = \alpha$ .



D Fumana, **ungasebenzisi khalthyhuleytha**, ivelyu nganye kwezilandelayo:

5.1.1  $\tan \alpha$  (1)

5.1.2  $\cos \alpha$  (2)

5.1.3  $\cos(\alpha + 45^\circ)$  ngefom elula (4)

- 5.2 Fumana, **ungasebenzisi khalthyhuleytha**, ivelyu ye-ekhsphreshin ezilandelayo :

$2\sin(-20^\circ) \cdot \sin 160^\circ - \cos 40^\circ$  (4)

- 5.3 Qaphela:  $3 \cos x \cdot \sin x + \tan x \cdot \cos^2(180^\circ - x)$

5.3.1 Simplifaya iekhsphreshin iye kwi trigonometrikh reyshiyo enye. (4)

- 5.3.2 Ngoko, bhala ireynji ka:

$f(x) = 3 \cos x \cdot \sin x + \tan x \cdot \cos^2(180^\circ - x)$  (2)

5.4 Ngqina iayidentithi:  $\frac{\cos 3x}{\cos x} = 4 \cos^2 x - 3$  (5)

- 5.5 Fumana ijeneral solushini ka  $x$  kwi ikhweyzhin elandelayo:

$3^{2 \tan x} - 3^{\tan x + 1} = 54$  (5)

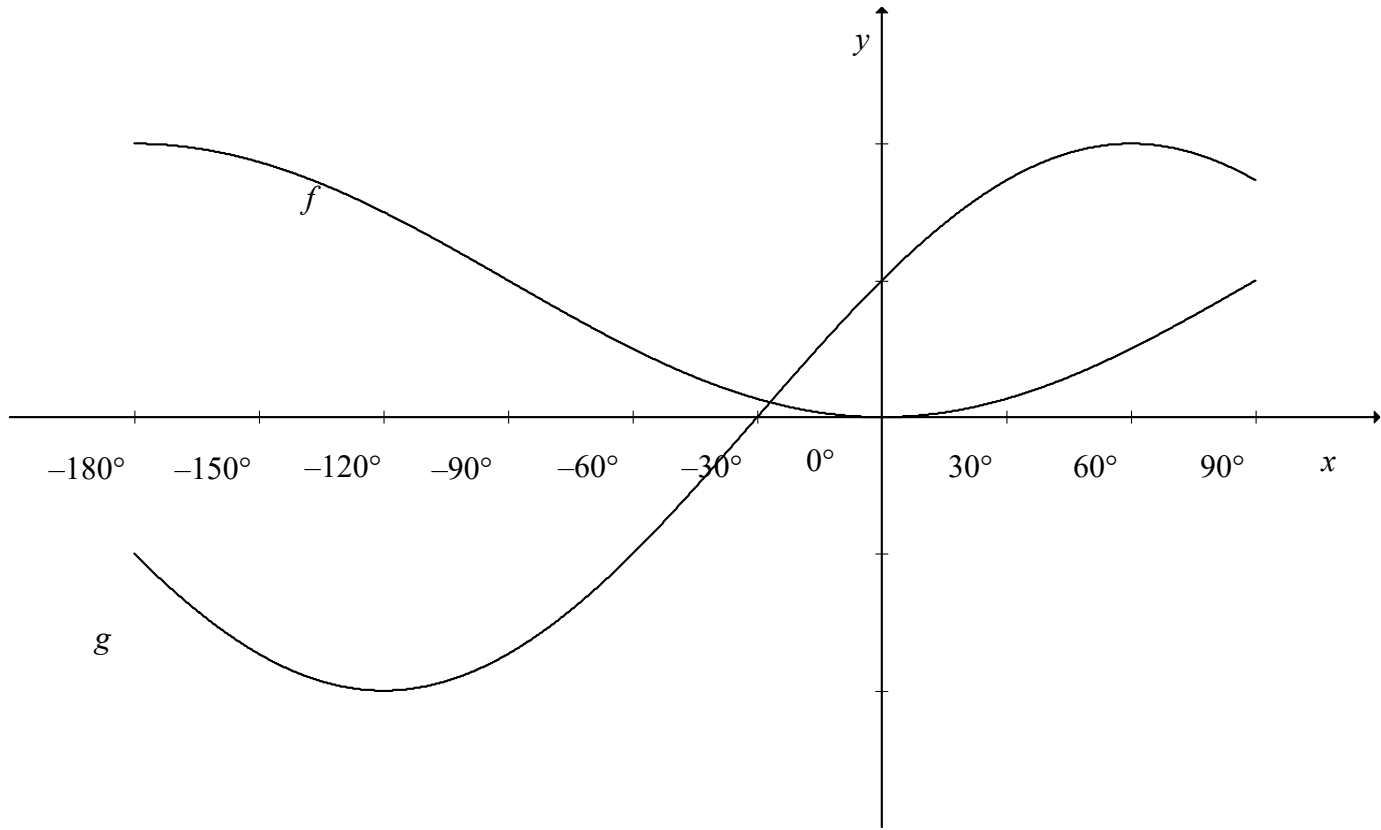
[27]





**UMBUZO 6**

Kwidayagram, iigrafu zika  $f(x) = -\cos x + 1$  no  $g(x) = 2\sin(x + 30^\circ)$  zizotywe kwiintaval ka  $x \in [-180^\circ; 90^\circ]$ .



6.1 Zeziphi iivelyu zika  $x$ ,  $x \in [-180^\circ; 90^\circ]$ , apho anokuba:

6.1.1  $f(x) \cdot g(x) \geq 0$  (2)

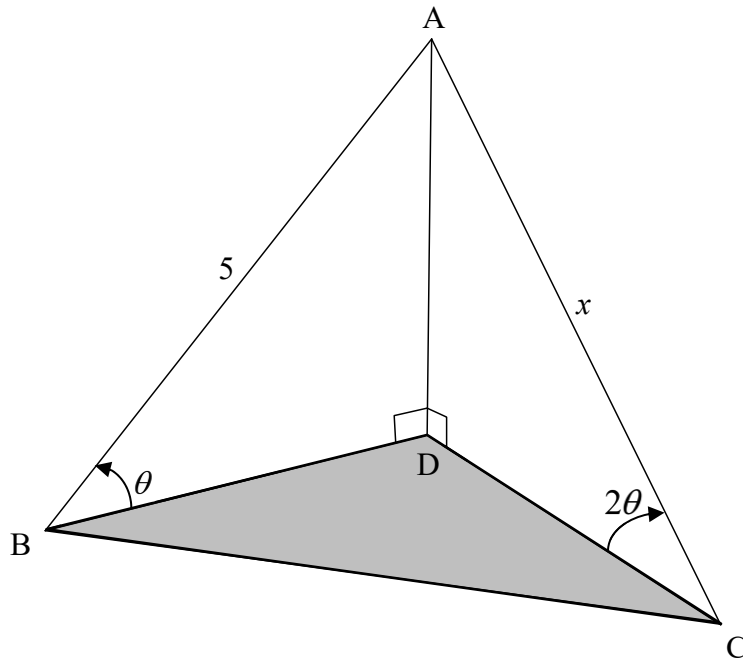
6.1.2  $g(x) = -1$  (2)

6.2 I  $y$ -ekhziz ihanjisiwe  $90^\circ$  ukuya ekunene. Fumana i-ikhweyzhin entsha yigrafu ebisakubizwa ngo  $f$ , ngefom yayo elula. (2)  
[6]



**UMBUZO 7**

Kwidayagram, B, C no D bakwi pleyini ehorizontali enye. AD yipali evethikhal ebotshelwe ngeekheybhile ezimbini, uAB no AC. Iengile ze eleveyshin ukusuka kuB no C ukuya kuA, imiphezulu yepali, ngu  $\theta$  and  $2\theta$  ngokulandelelana.  $AB = 5$  yuniti no  $AC = x$  yuniti.



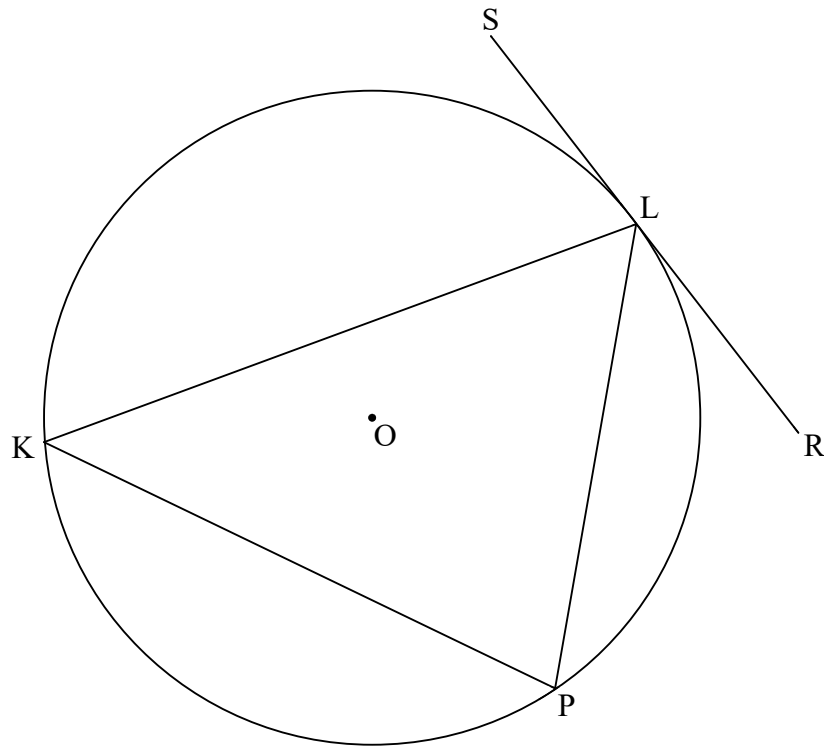
7.1 Bonisa ukuba  $x = \frac{5}{2 \cos \theta}$  (5)

7.2 Khaltyhuleytha ubude buka BC xa ngaba kunikwe ukuba  $\hat{BAC} = 112^\circ$  and  $\theta = 30^\circ$ . (3)  
[8]



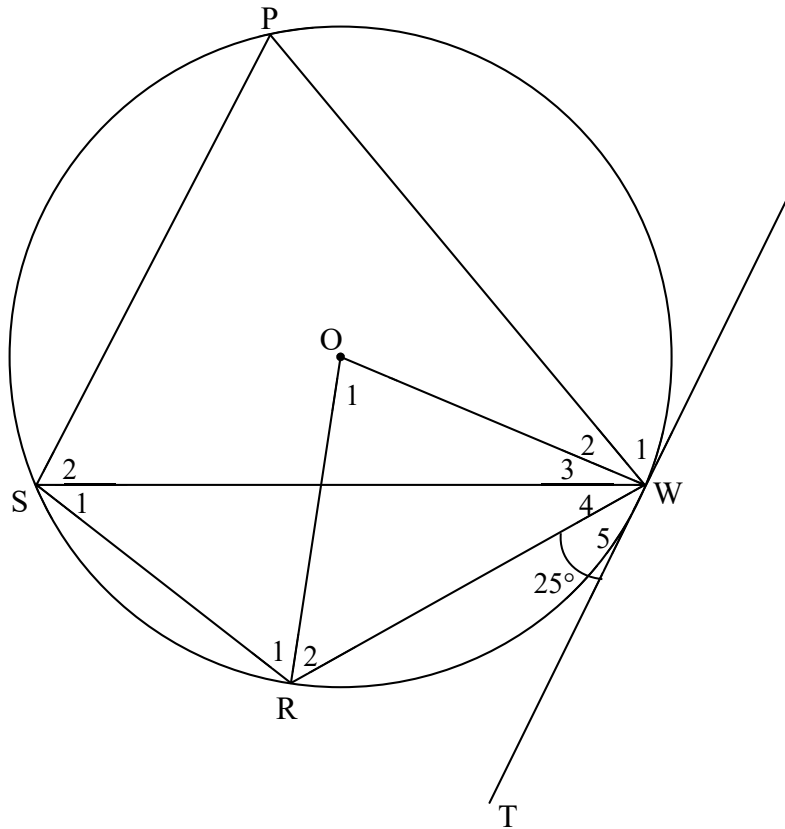
**UMBUZO 8**

8.1 Kwidayagram, iikhodi uKL, LP no KP zizotywe kwisekile, enombindi ku O. SLR yithanjent kwisekile ku L.



Ngqina ukuba ithiyorem echaza ukuba iengile phakathi kwethanjent SLR ne khodi KL ilingana neengile kwiolthaneyth segment, ngoko ngqina ukuba  $\hat{S}LK = \hat{P}$ . (6)

8.2 Kwidayagram engezantsi, PWRS yisayklich khwadrilateral kwisekile, enombindi ongu  $O$ .  $\Delta PSW$  yiekhwilaieral trayengile.  $TW$  yithanjent kwisekile ku  $W$ . IiRadiyasi  $OR$  no  $OW$  Bazotywe.  $\hat{W}_5 = 25^\circ$ .



8.2.1 Fumana, unika izizathu, isayzi ka:

(a)  $\hat{S}_1$  (2)

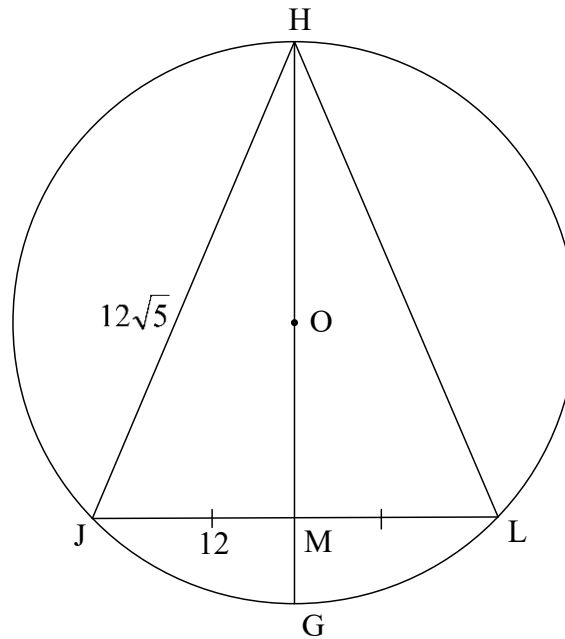
(b)  $\hat{O}_1$  (2)

(c)  $\hat{R}_1$  (5)

8.2.2 Ngqina ukuba  $SP \parallel TW$ . (3)



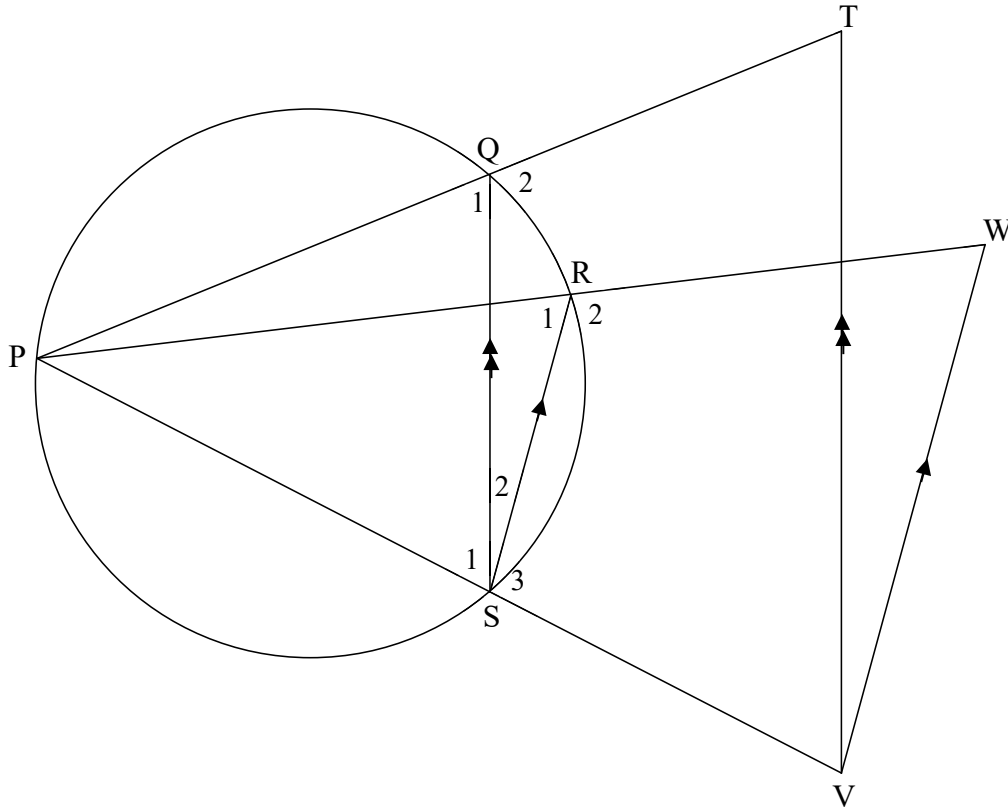
- 8.3 Kwidayagram engezantsi, isekile enombindi kaO izotywe. H, J, G no L zipoynti kwisekile.  $\Delta HJL$  lizotywe. HOG unqumla phakathi uJL ku M.  
 $HJ = 12\sqrt{5}$  yunithi no  $JM = 12$  yunithi.



- 8.3.1 Ukuba uMG= 6 unithi no OM=  $x$ , bhala HM ngethem zika  $x$ . (2)
- 8.3.2 Khaltyhuleytha, unika izizathu, ubude beradiyasi yesekile. (5)  
**[25]**

**UMBUZO 9**

Kwi dayagram engezantsi, P, Q, R no S zipoyinti kwisekile. PS, PQ no PR batsaliwe ku V, T no W ngokulandelelana.  $VT \parallel SQ$  no  $SR \parallel VW$ .



Ngqina, unika izizathu, ukuba :

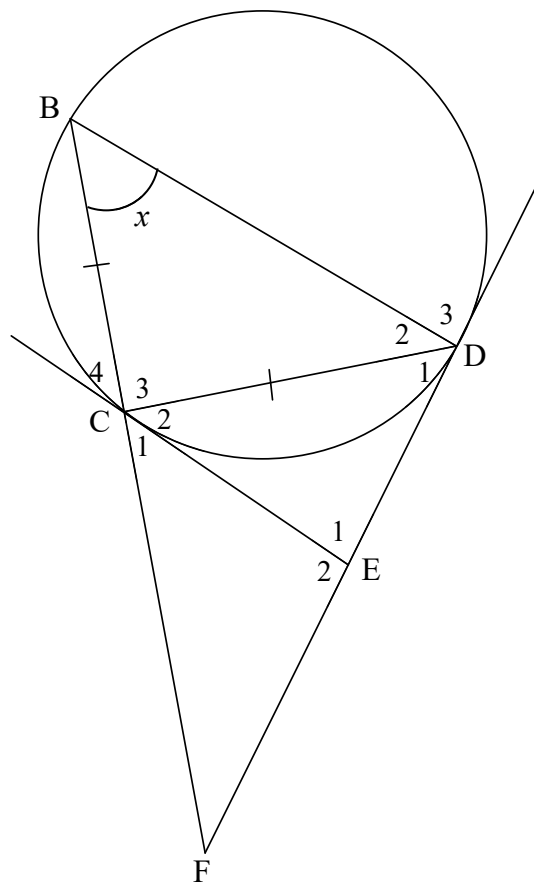
9.1  $\frac{TQ}{QP} = \frac{WR}{RP}$  (3)

9.2 TPVW yi sayklikh khwadrilatheral (5)  
[8]



**UMBUZO 10**

Kwidayagram engezantsi, B, C no D ziipoyinti kwisekile ukuze  $BC = CD$ . EC no ED zithanjent kwisekile C no D ngokulandelelana. BC utsaliwe wadibana nethanjent DE etsaliweyo ukuya ku F.  $\hat{B} = x$ .



10.1 Ngqina, unika izizathu, ukuba:

10.1.1  $\hat{E}_1 = 180^\circ - 2x$  (5)

10.1.2  $\triangle ECD \parallel \triangle CBD$  (3)

10.2 Ngqina, unika izizathu, ukuba:

10.2.1  $CD^2 = CE \cdot BD$  (3)

10.2.2  $\frac{CF^2}{EF^2} = \frac{BD}{DE}$  (6)  
[17]

**AMANQAKU EWONKE: 150**

a



**IPHEPHA LOLWAZI**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

