# KING DAVID HIGH SCHOOL LINKSFIELD

**MATHEMATICS PAPER 2**

**GRADE 11**

**NOVEMBER EXAMINATION 2016**

**Total: 100 marks**

**Reading Time: 10 minutes**

**Writing Time:** $2\frac{1}{2}$ **hours**

**Name:** memo

This paper comprises a question paper of **15** pages (including the front cover).
Check that your paper is complete
Write your name in the space above.

Please read the following instructions carefully:

1. Number all questions exactly as they appear on the question paper.
2. Pay careful attention to time management and mark allocation.
3. Write legibly and not in pencil.
4. Non programmable calculators may be used unless otherwise instructed.
5. All answers to be given to 2 decimal places where appropriate.
6. **All necessary calculations must be clearly shown. You will NOT receive full credit if you write down only the answers and show no working out.**

| Q1 [11] | Q2 [8] | Q3 [9] | Q4 [11] | Q5 [7] | Q6 [8] | |
|---|---|---|---|---|---|---|
| | | | | | | |
| Q7 [6] | Q8 [5] | Q9 [8] | Q10 [10] | Q11 [9] | Q12 [8] | TOTAL [100] |
| | | | | | | |

FORMULAE:

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

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

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

$$y=mx+c$$

$$y-y_{1-}=m(x-x_1)$$

$$m=\tan\theta$$

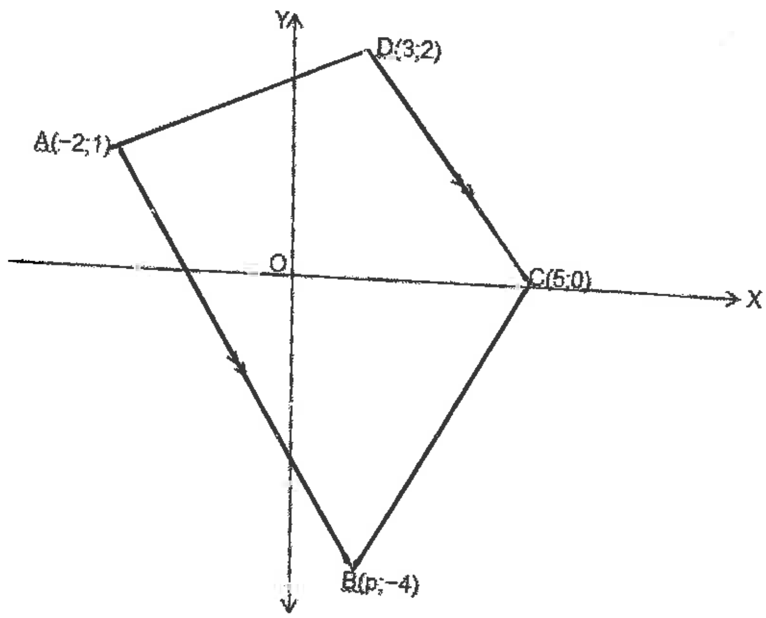
In $\Delta ABC$:

$$\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$$

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

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

Question 1 [11marks]




A(-2;1), B(p;-4), C(5;0) and D(3;2) are vertices of a trapezium ABCD with AB//DC.

a) Show that p=3. (3)

$m_{AB} = m_{DC}$ ✓

$\therefore \frac{-5}{p+2} = \frac{-2}{2}$ ✓

$-10 = -2p-4$

$-6 = -2p$

$3 = p$ ✓

b) (I) Calculate AB in simplest surd form. (2)

$AB = \sqrt{(5)^2+(-5)^2}$

$= \sqrt{50}$ ✓

$AB = 5\sqrt{2}$ ✓

(II) Determine AB : CD in its simplest form (3)

$CD = \sqrt{(2)^2+(-2)^2}$ ✓

$= 2\sqrt{2}$

$\therefore \frac{AB}{CD} = \frac{5}{2}$ ✓✓

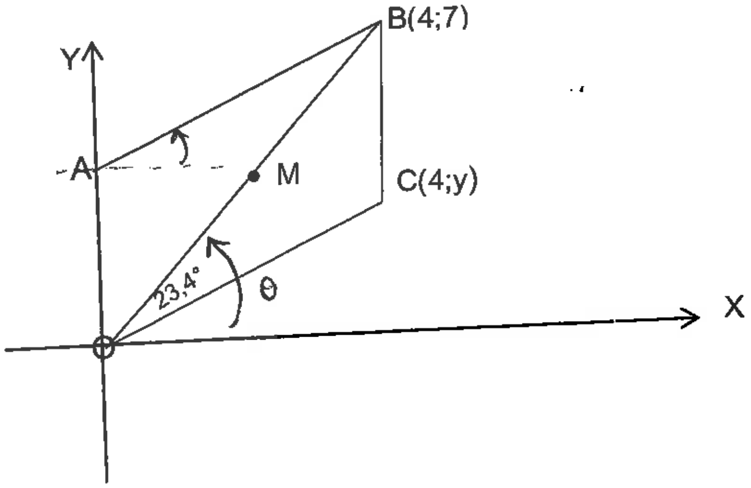
c) R(-1;k) is collinear with A and C. Determine the value of k. (3)

$m_{AR} = m_{AC}$

$\frac{k-1}{1} = \frac{1}{-7}$

$k = \frac{6}{7}$

## Question 2 [8 marks]




OABC is a parallelogram where O is the origin and A lies on the y-axis. $B\hat{O}C = 23{,}4°$

a) Determine the co-ordinates of M the point of intersection of the diagonals of AOBC. (2)

$M\left(2; \frac{7}{2}\right)$

b) Calculate $B\hat{O}X$ to one decimal digit. (3)

$m_{BOX} = \frac{7}{4}$

$\tan\theta = \frac{7}{4}$

$\therefore \theta = 60{,}3°$

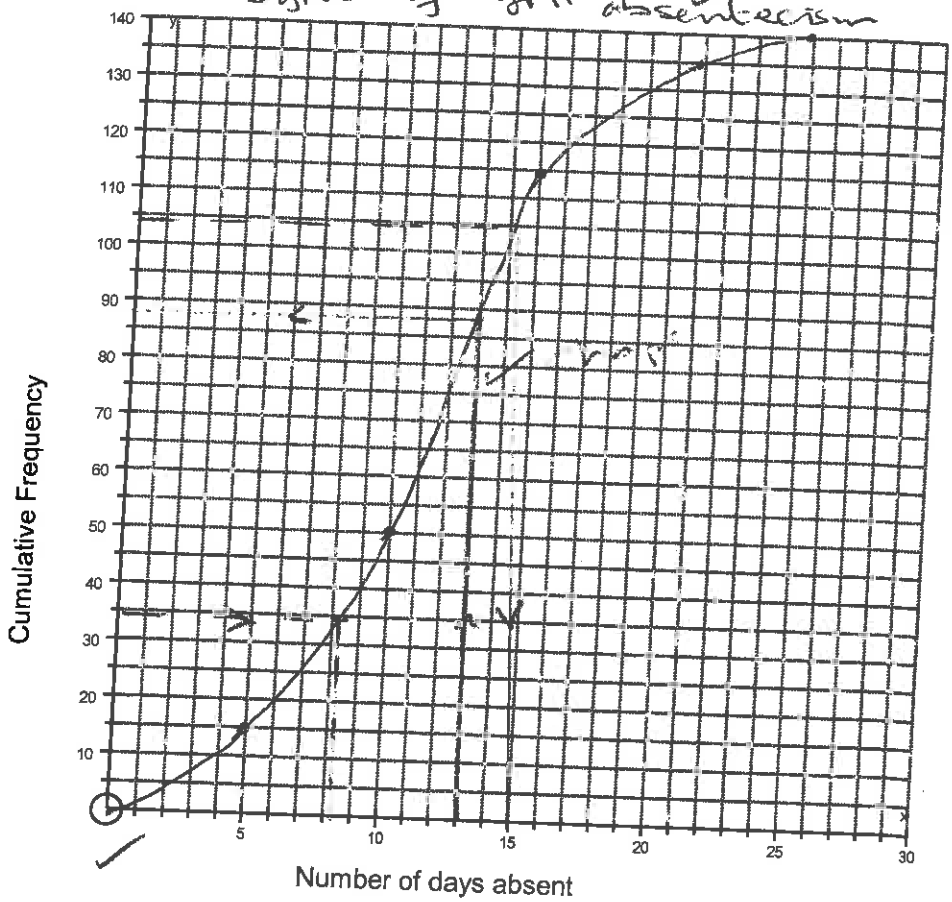
## Question 6 [8 marks]

The following table shows the absenteeism of 140 grade 11's in one year.

| Number of Days Absent | Frequency | Cumulative Frequency |
|---|---|---|
| $0 < d \leq 5$ | 15 | 15 |
| $5 < d \leq 10$ | 35 | 50 |
| $10 < d \leq 15$ | 65 | 115 |
| $15 < d \leq 20$ | 20 | 135 |
| $20 < d \leq 25$ | 5 | 140 |

(a) Fill in the table above and draw an ogive using the grid below. (4)

Ogive of Gr 11 absenteeism




(b) Using the given information, determine the approximate number of students who were absent for:

13 days or less. $\approx 88$ (1)

(c) Determine the inter-quartile range of days absent (3)

$Q_1 \approx 8,5$

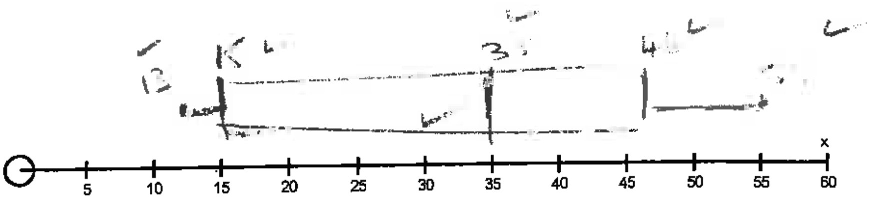
$Q_3 \approx 15$

$\therefore IQR \approx 6,5$

## Question 7 [6 marks]

Given the stem-and-leaf plot below, draw the box-and-whisker plot for the same data on the scale provided. (6)

| | |
|---|---|
| 0 | 3 |
| 1 | 4 7 |
| 2 | 3 3 4 6 |
| 3 | 2 2 3 4 5 5 |
| 4 | 1 2 2 3 6 6 |
| 5 | 0 3 4 4 5 |




## Question 8 [5 marks]

A start-up business employs 7 people whose ages are 26, 26, 26, 26, 27, 27 and 32.

Peasrson's index of skewness can be used to determine whether the data is symmetric or skewed.
If the index is between −1 and 1 then the distribution is symmetric. If the index is less than −1 then it is skewed to the left and if the index is greater than 1, then it is skewed to the right. The formula is:

$$\text{Index} = \frac{3\ (\text{mean} - \text{median})}{\text{standard deviation}}$$

Use Pearson's Index of Skewness to determine whether the ages of the employees are skewed , and if yes in which direction. (5)

Mean = 27,1

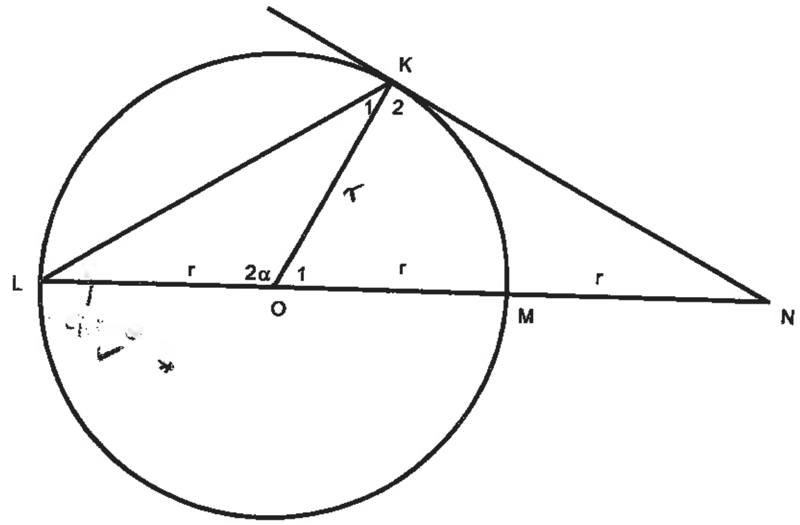
Median = 26

SD = 2,03

$\therefore$ Index = $\frac{3(1,1)}{2,03}$ = 1,63

$\therefore$ skewed right

## Question 9 [8 marks]




O is the centre of the circle. OM = MN = r. $L\hat{O}K = 2\alpha$ and KN is a tangent to the circle.

a) Using the fact that $\boxed{\sin 2\alpha = 2\sin\alpha\cos\alpha}$ prove that KL = 2r $\sin\alpha$ (4)

In $\Delta$ KOL: $\frac{KL}{\sin 2\alpha} = \frac{r}{\sin(90^\circ - \alpha)}$

$KL = \frac{r(2\sin\alpha\cancel{\cos\alpha})}{\cancel{\cos\alpha}}$

$= 2r\sin\alpha$

b) Determine the area of $\Delta KLN$ in terms of r and $\alpha$ (4)

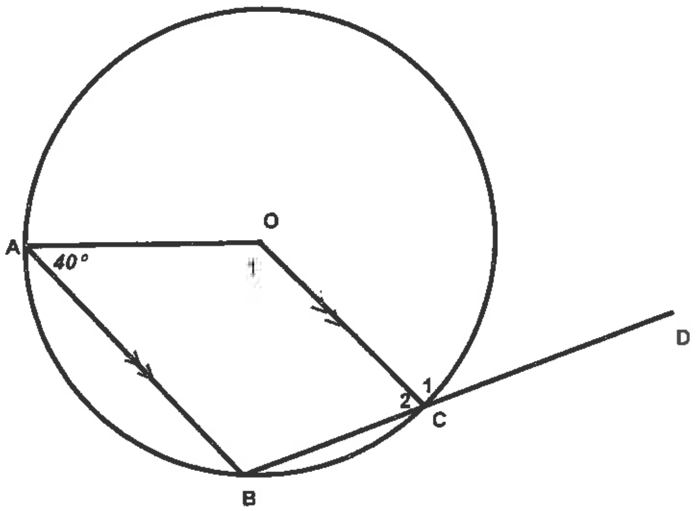
$\text{area} = \frac{1}{2}(2r\sin\alpha)(3r)\sin(90°-\alpha)$

$= 3r^2 \sin\alpha\cos\alpha$

an.

## Question 10 [10 marks]

(a)




In the figure, O is the centre of the circle. AB // OC and $\hat{A} = 40°$. Determine, with reasons, the size of $O\hat{C}D$ (6)

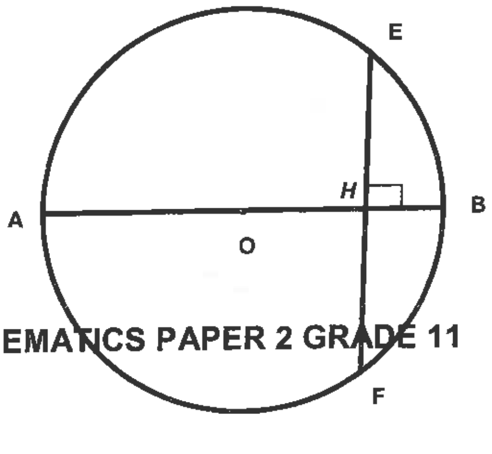
$\hat{O}_1 = 140°$ co-int. ∠s supp AB∥OC

∴ Reflex $A\hat{O}C = 220°$

∴ $\hat{B} = 110°$ ∠ at O = 2∠ at circumf

∴ $\hat{C}_1 = 110°$ corresp ∠s AB∥OC

(b) In the figure alongside, AB is a diameter of the circle centre O. EF is a chord perpendicular to AB. If OH = x, EF = 12units and HB = 2 uniits, determine x. (4)



OE $= x+2 =$ OB ✓ radii

FH $=$ HE $= 6$ ✓ line from ⊙ ⊥ chord

By Pythag $(x+2)^2 = x^2 + (6)^2$

$x^2 + 4x + 4 = x^2 + 36$

$4x = 32$

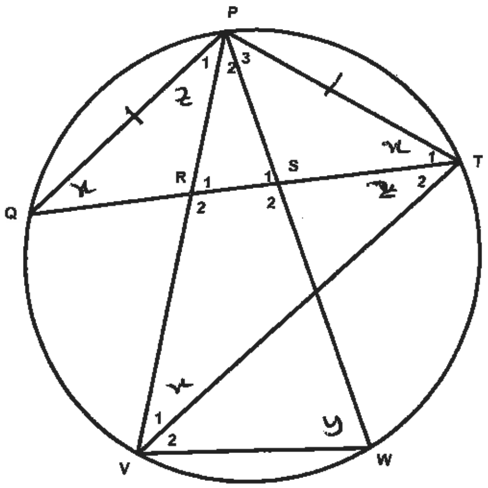
$x = 8$ ✓

**Question 11** [9 marks]

a) Complete the statement:

The exterior angle of a triangle is equal to the sum of the two interior opposite angles. (1)

b)




In the figure, PQ = PT. $\hat{Q} = x$; $\hat{W} = y$ and $\hat{P}_1 = z$. Prove:

(i) $y = x + z$ (4)

$\hat{T}_1 = \hat{Q} = x$ ✓ ∠s opp = sides

$\hat{P}_1 = \hat{T}_2 = z$ ✓ ∠s in same seg

$\hat{T}_1 + \hat{T}_2 = y$ ✓ ∠s in same seg

$\therefore x + z = y$

(ii) RSWV is a cyclic quadrilateral. (4)

$\hat{R}_1 = x + z$    ext ∠ of Δ

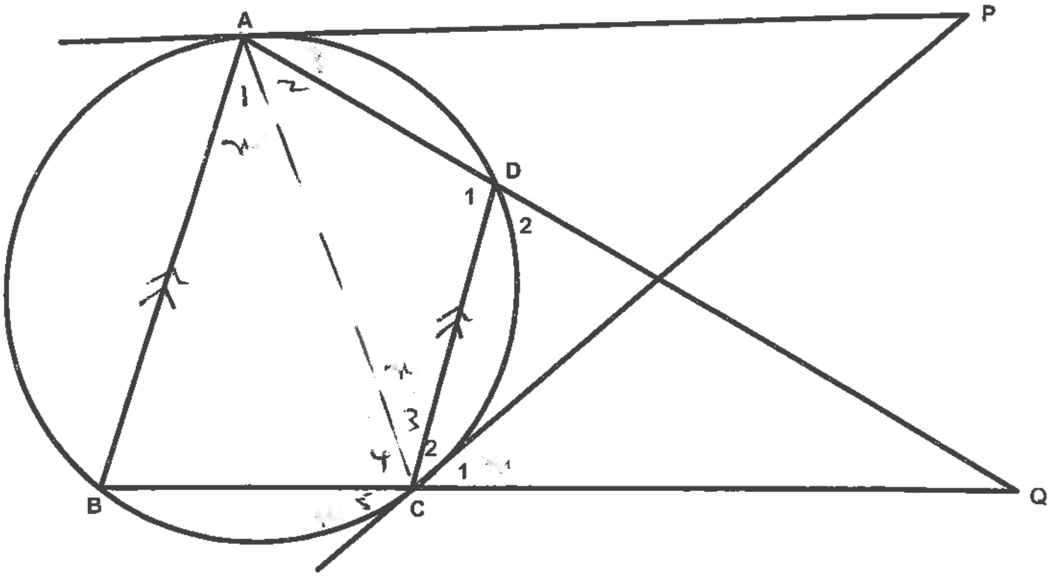
$= y$    proved

$= \hat{W}$

∴ RSWV cyclic quad { converse of ext ∠ of cyclic quad

or { ext ∠ = int. opp ∠ of quad

<u>Question 12</u> [8 marks]




In the figure, AB //CD. PA and PC are tangents to the circle at A and C. Prove:

a) $A\hat{C}D = \hat{C}_1$ (4)

Join AC

$\hat{C}_1 = \hat{C}_5$    vert opp ∠s

$\hat{C}_5 = \hat{A}_1$    tan chord th

$\hat{A}_1 = \hat{C}_3$    alt ∠s AB ∥ CD

∴ $\hat{C}_3 = \hat{C}_1$

b) PACQ is a cyclic quadrilateral. (4)

$\hat{A}_3 = \hat{C}_3$ tan chord th

$= \hat{C}_1$ proved

$= x$

$\therefore$ PACQ cyclic conv of $\angle$s in same seg