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# Basic Education

KwaZulu-Natal Department of Basic Education
REPUBLIC OF SOUTH AFRICA

## MATHEMATICS P2

## COMMON TEST

## JUNE 2015

## NATIONAL SENIOR CERTIFICATE

## GRADE 11

**MARKS:** 100

**TIME:** 2 hours

**This question paper consists of 10 pages, an information sheet and Diagram Sheets.**

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## INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Clearly show all calculations and diagrams that you have used in determining your answers.
3. You may use an approved scientific calculator (non-programmable and non-graphical).
4. If necessary round off answers to TWO decimal places, unless stated otherwise.
5. Answers only will not necessarily be awarded full marks.
6. Diagrams not necessarily drawn to scale.
7. Number the answers correctly according to the numbering system used in this question paper.
8. Write neatly and legible.

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Department:
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KWAZULU-NATAL

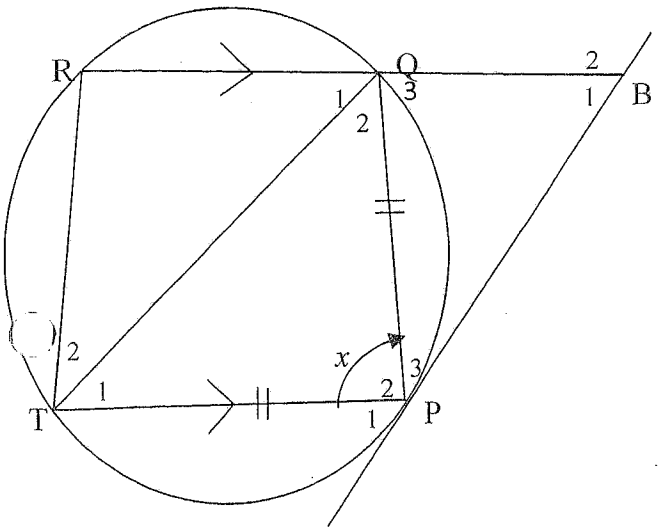
**TO: THE CHIEF INVIGILATOR(S) OF ALL CENTRES OFFERING NATIONAL SENIOR CERTIFICATE – COMMON TEST JUNE 2015 GRADE 11: MATHEMATICS P2**

**ERRATA: MATHEMATICS P2**

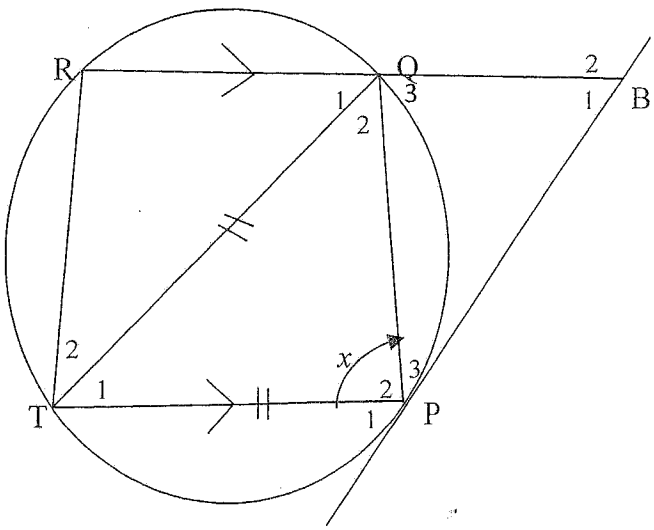
| ERROR | CORRECTION |
|---|---|
| Page 3<br><br>Question 1:<br><br>1.1.7 in the form of $y = mx + x\ldots$ | Page 3<br><br>Question 1:<br><br>1.1.7 in the form of $y = mx + c\ldots$ |

**QUESTION FIVE: PAGE 10**

**ERROR**




**CORRECTION**




Kindly ensure that all candidates are informed of the Errata.

MR R.C. PENNISTON
SENIOR MANAGER
PROVINCIAL EXAMINATION ADMINISTRATION

12/6/2015
DATE

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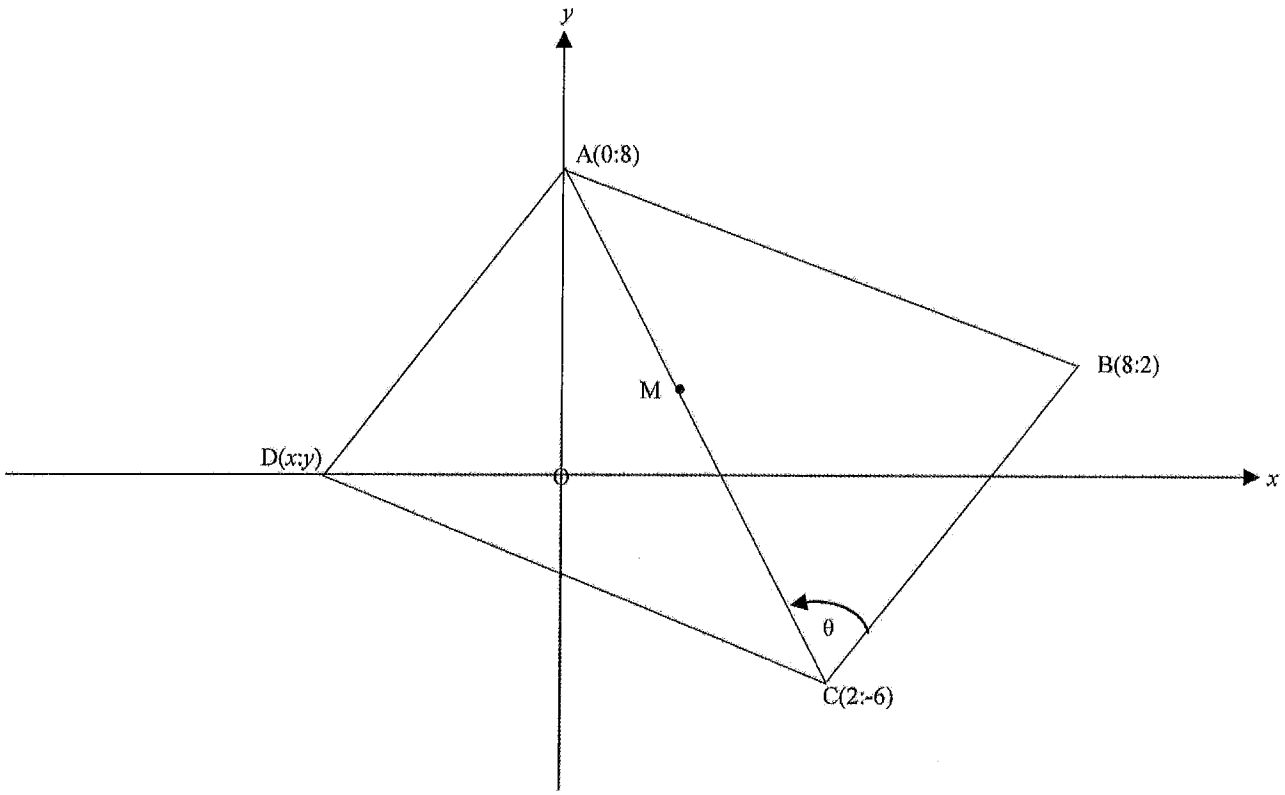
## QUESTION ONE

1.1 In the diagram below A(0;8), B(8;2), C(2;-6) and D $(x\,;y)$ are the vertices of a parallelogram. M is the midpoint of AC. $A\hat{C}B = \theta$.




1.1.1 Calculate the lengths of AB and BC. (4)

1.1.2 Determine the coordinates of M. (3)

1.1.3 Prove that BM is perpendicular to AC. (4)

1.1.4 Prove that $A\hat{B}C = 90^{o}$ (4)

1.1.5 What type of triangle is ΔABC? (2)

1.1.6 Determine the area of Δ ABC. (2)

1.1.7 Determine the equation of BM in the form $y = mx + x$. (3)

1.1.8 Calculate the size of angle θ. (4)

1.1.9 Determine the coordinates of D. (2)

1.2 Prove that the point (-4;11) lies on the line $3x + 4y = 32$ (3)

1.3 Given the points P(6;5); Q(3;2); R $(2m\,;\,m+4)$ and T $\left(\frac{5}{2}\,;\,\frac{1}{2}\right)$. Calculate the value of $m$ if PQ is parallel to RT. (4)

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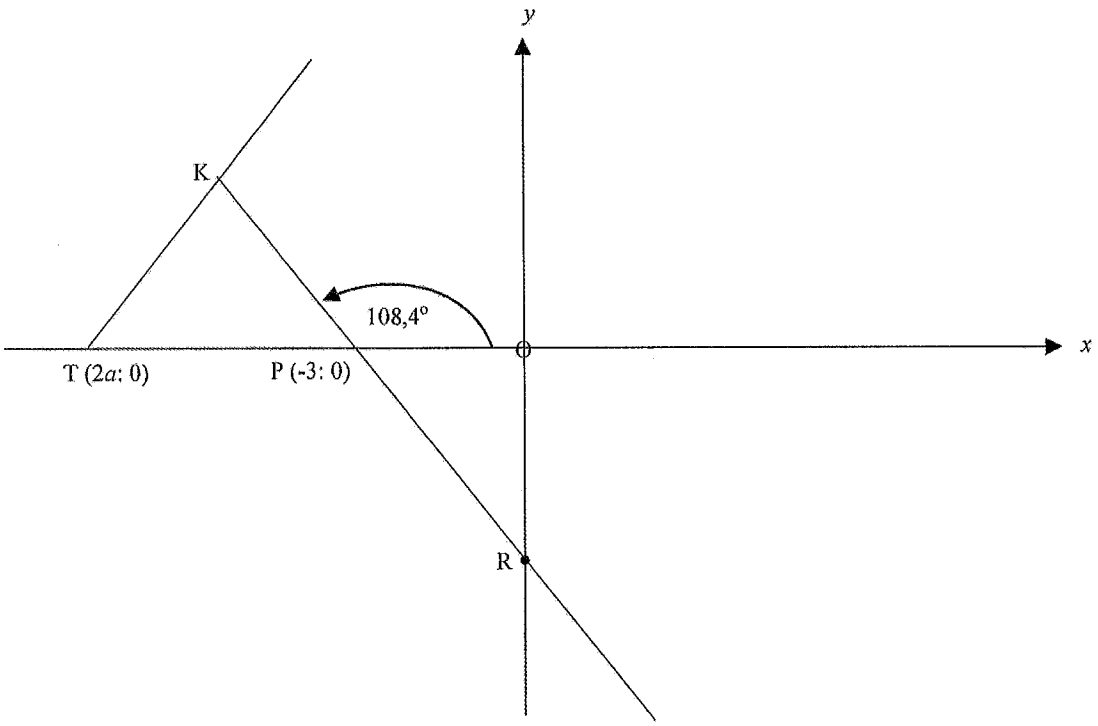
1.4 In the diagram below P is a point (-3;0) and T is $(2a\ ;\ 0)$.The inclination of the line PR is 108,4° and R is the y-intercept of PR.




Calculate:

1.4.1 the gradient of PR, to the nearest integer value. (2)

1.4.2 the equation of PR in the form $y = mx + c$. (2)

1.4.3 the coordinates of R. (2)

1.4.4 If $T(2a\ ;\ 0)$; $Q\ (a;b)$ and R lie on the same straight line.

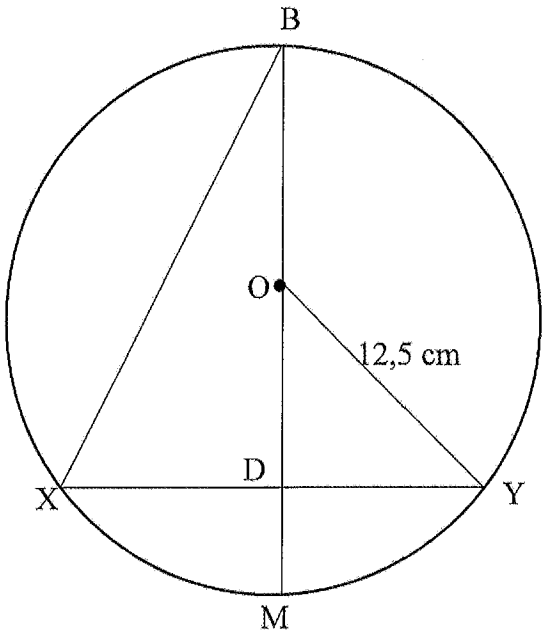
Prove that $b = \frac{-9}{2}$ (4)

**[45]**

## QUESTION TWO

2.1 Complete the following statement:
The line drawn from the centre of a circle, perpendicular to a chord _____. (2)

2.2 In the diagram BOM is a diameter of a circle with centre O. OD is perpendicular to the chord XY. OY= 12,5 cm and XY = 24 cm.




Calculate the lengths of:

2.2.1 MD. (4)

2.2.2 BX. (4)

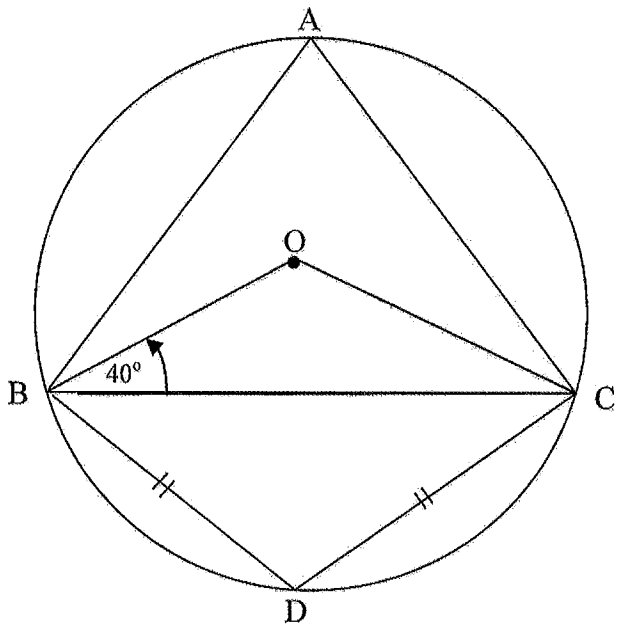
**[10]**

## QUESTION THREE

3.1 Complete the statement:

The angle subtended by an arc at the centre of the circle is _____. (2)

3.2 In the diagram A, B, C and D are points on the circle with centre O. $O\hat{B}C = 40°$.
BD = DC.




Calculate, with reasons, the value of:

3.2.1 $B\hat{A}C$. (4)

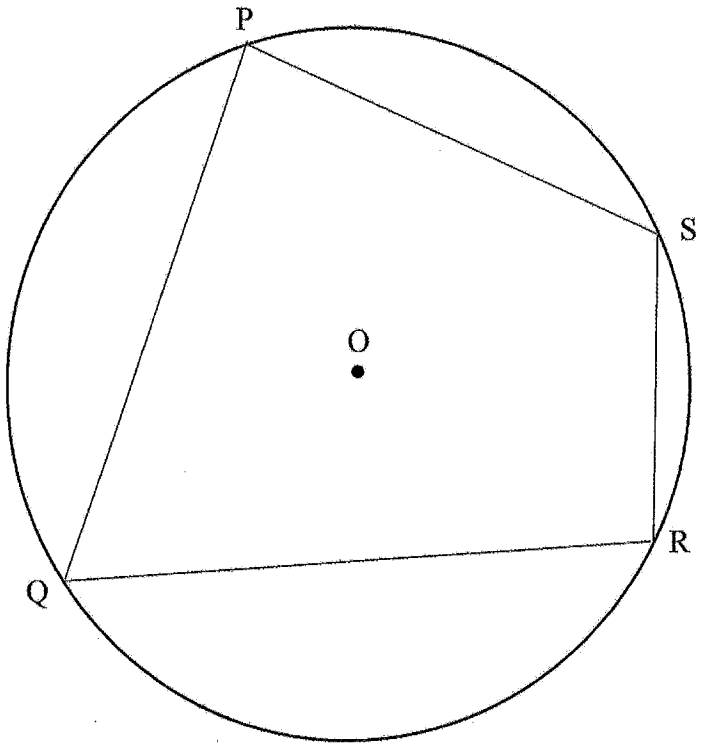
3.2.2 $B\hat{D}C$. (2)

3.2.3 $D\hat{C}B$. (2)

**[10]**

## QUESTION FOUR

4.1 In the diagram below, O is the centre of the circle. Use the diagram to prove the theorem which states that : If PQRS is a cyclic quadrilateral then $P\hat{Q}R + P\hat{S}R = 180^{o}$. (6)

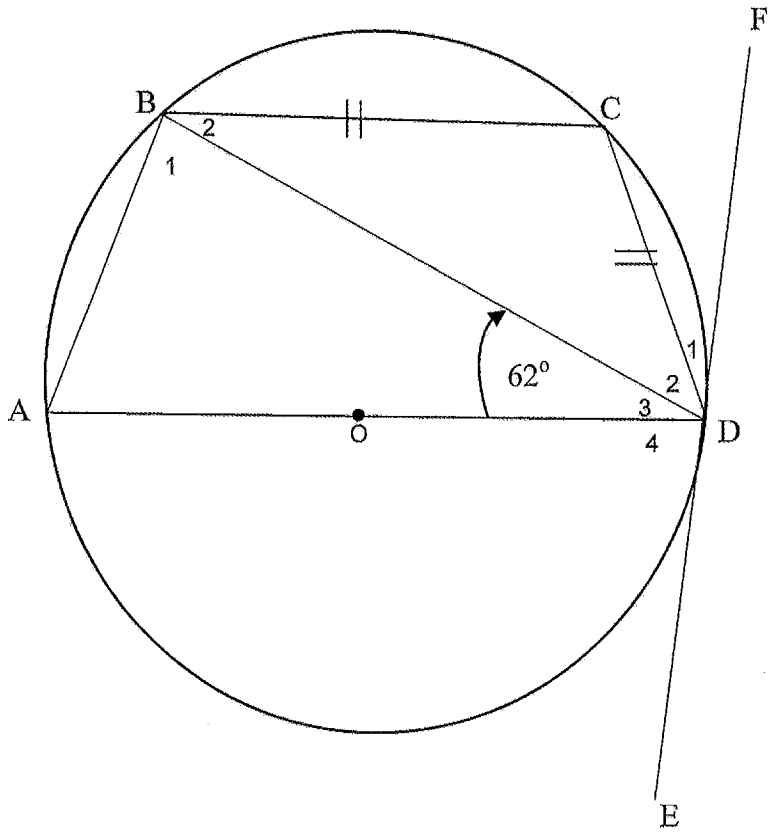


4.2 Complete this statement:

The angle between a tangent to a circle and a chord is _____. (2)

4.3 In the diagram below, AOD is a diameter of the circle and EDF is a tangent to the circle at D.

$A\hat{D}B = 62^\circ$ and BC = CD.

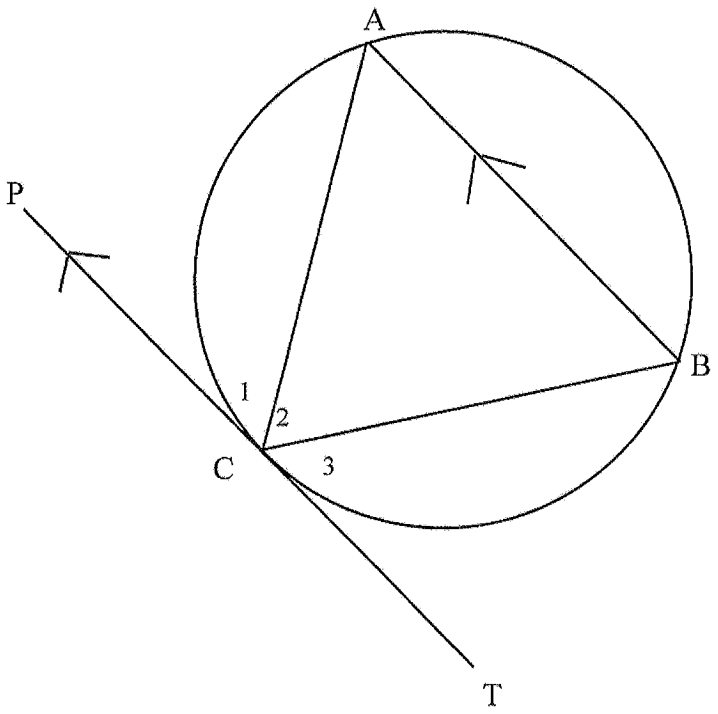



Calculate, with reasons, the numerical value of:

4.3.1 $B\hat{C}D$. (4)

4.3.2 $C\hat{D}F$. (4)

4.4 In the diagram, A, B and C are points on the circumference of a circle. PCT is a tangent to a circle at C and also parallel to AB.



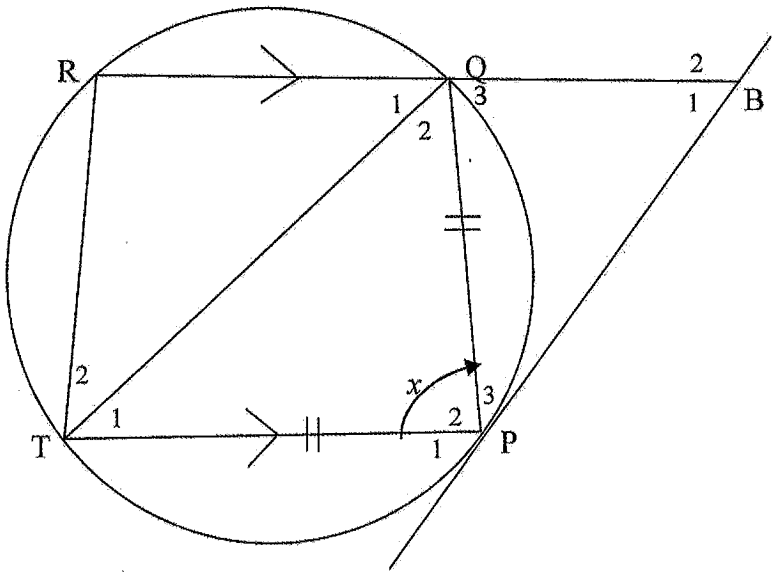

Prove that AC = BC (5)

**[21]**

**QUESTION FIVE**

In the diagram below, PQRT is a cyclic quadrilateral. PB is a tangent. RQB is a straight line. PT // BQR.

PT = QT and $\hat{P}_2 = x$.




5.1 Write down, with reason, $\hat{R}$ in terms of $x$. (2)

5.2 Write down, with reasons, FIVE other angles each equal to $x$. (10)

5.3 Prove that QP = BP (2)

**[14]**

**TOTAL: 100**

# INFORMATION SHEET: MATHEMATICS
# INLIGTINGSBLAD: WISKUNDE

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

$$A = P(1+ni) \qquad A = P(1-ni) \qquad A = P(1-i)^n \qquad A = P(1+i)^n$$

$$\sum_{i=1}^{n} 1 = n \qquad \sum_{i=1}^{n} i = \frac{n(n+1)}{2} \qquad T_n = a + (n-1)d \qquad S_n = \frac{n}{2}\left(2a + (n-1)d\right)$$

$$T_n = ar^{n-1} \qquad S_n = \frac{a\left(r^n - 1\right)}{r-1} \; ; \quad r \neq 1 \qquad S_\infty = \frac{a}{1-r} \; ; \; -1 < r < 1$$

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad \mathrm{M}\left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

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

*In ΔABC:* $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$ $\qquad a^2 = b^2 + c^2 - 2bc.\cos A$ $\qquad$ *area* $\Delta ABC = \dfrac{1}{2}ab.\sin C$

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

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

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

$$(x\,;\,y) \to (x\cos\theta + y\sin\theta\,;\, y\cos\theta - x\sin\theta) \qquad (x\,;\,y) \to (x\cos\theta - y\sin\theta\,;\, y\cos\theta + x\sin\theta)$$

$$\bar{x} = \frac{\sum fx}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)} \qquad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx \qquad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

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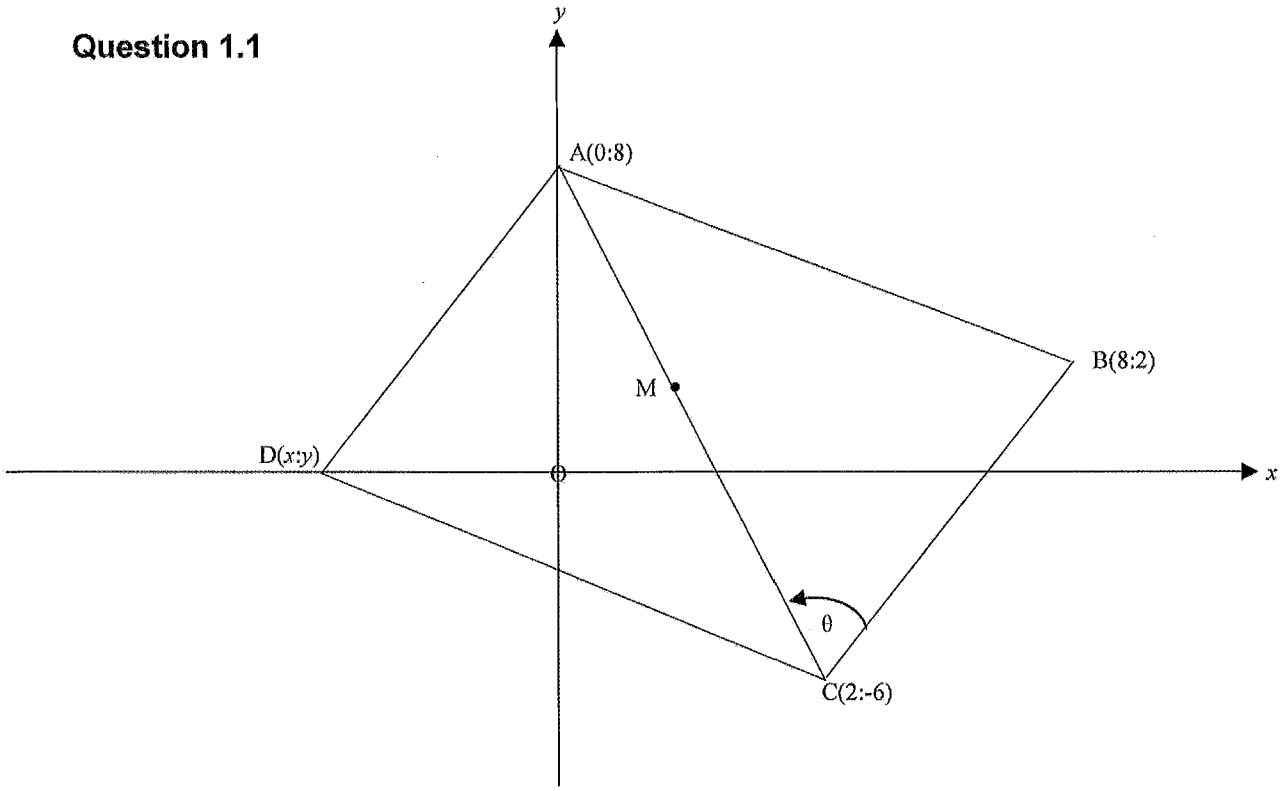
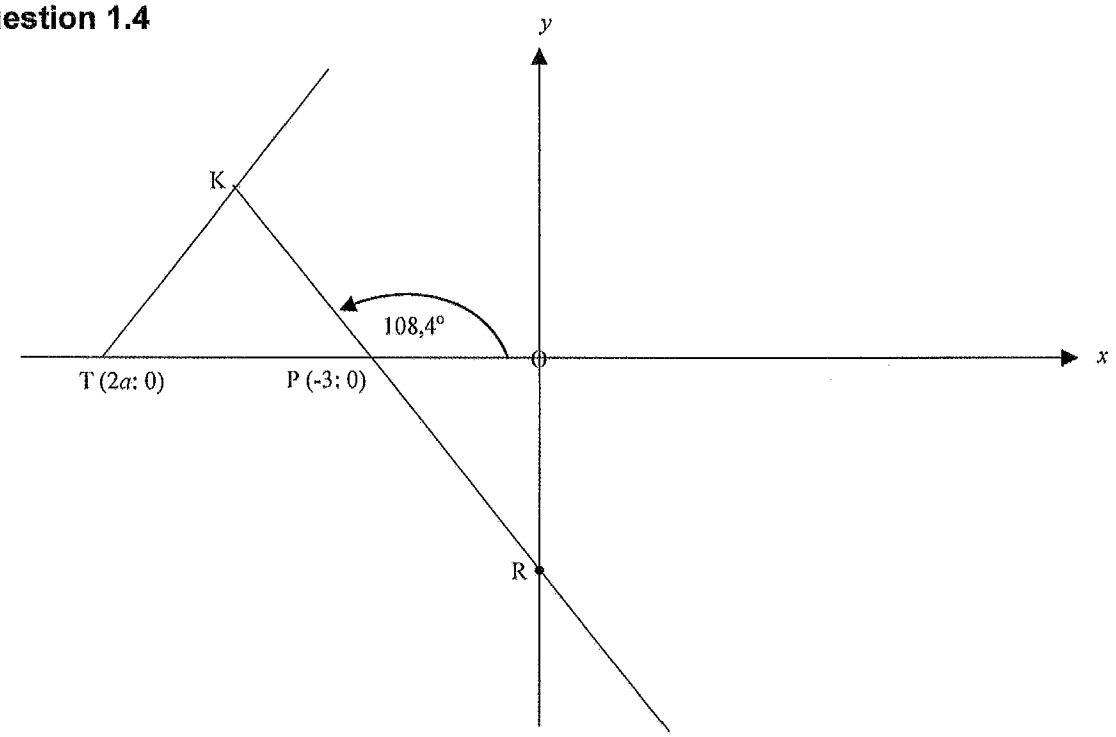
## DIAGRAM SHEETS

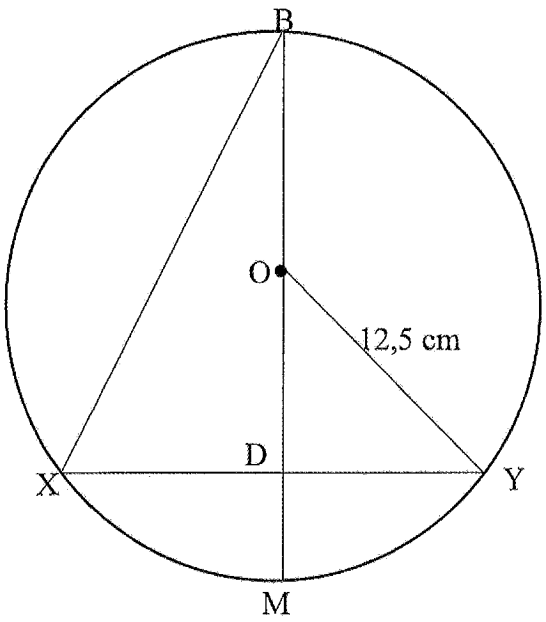
### Question 1.1



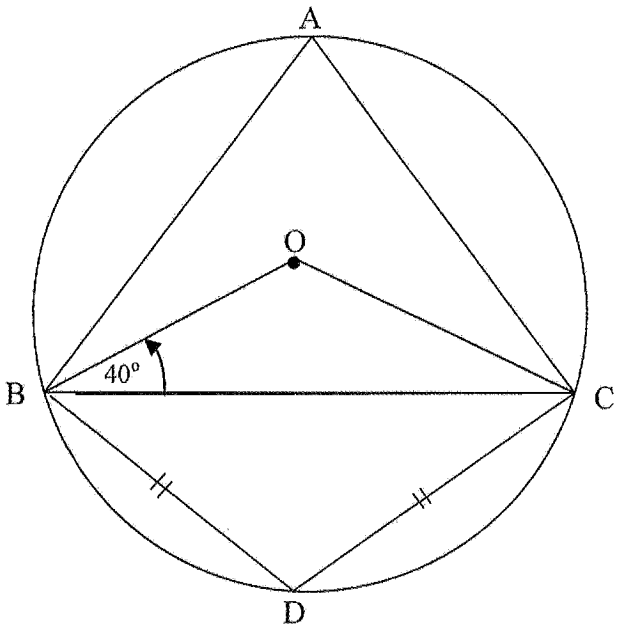

### Question 1.4



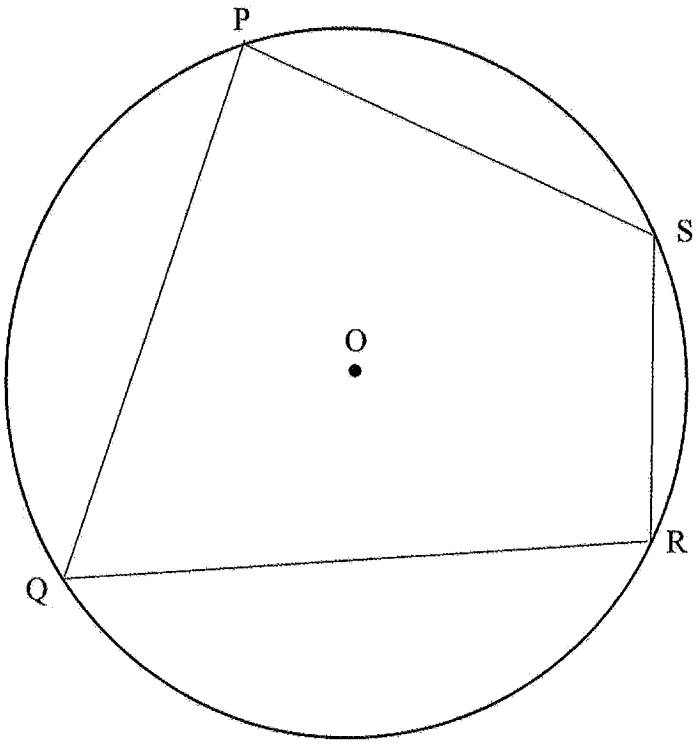
## Question 2.2



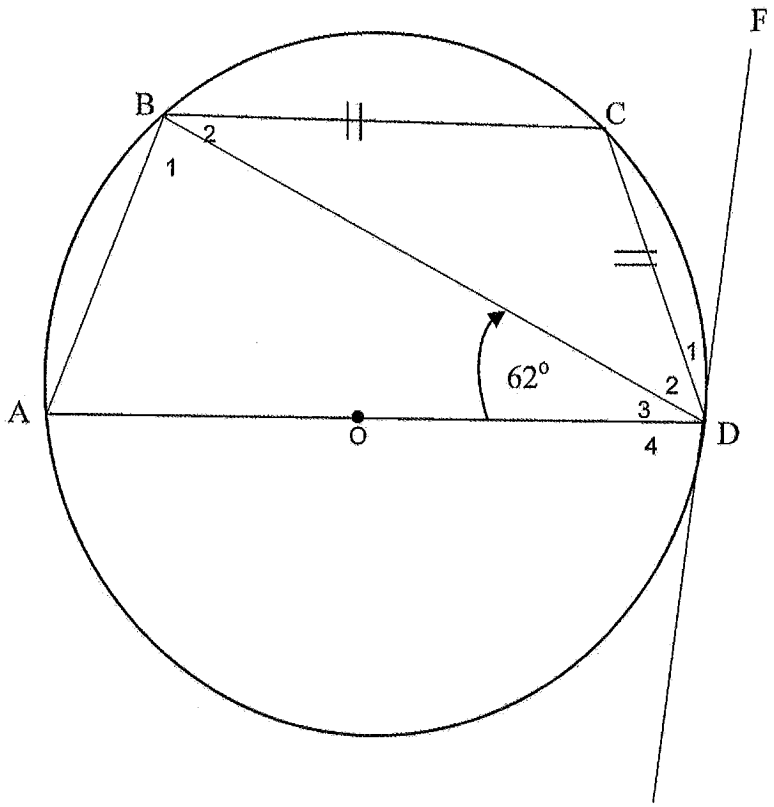

## Question 3.2



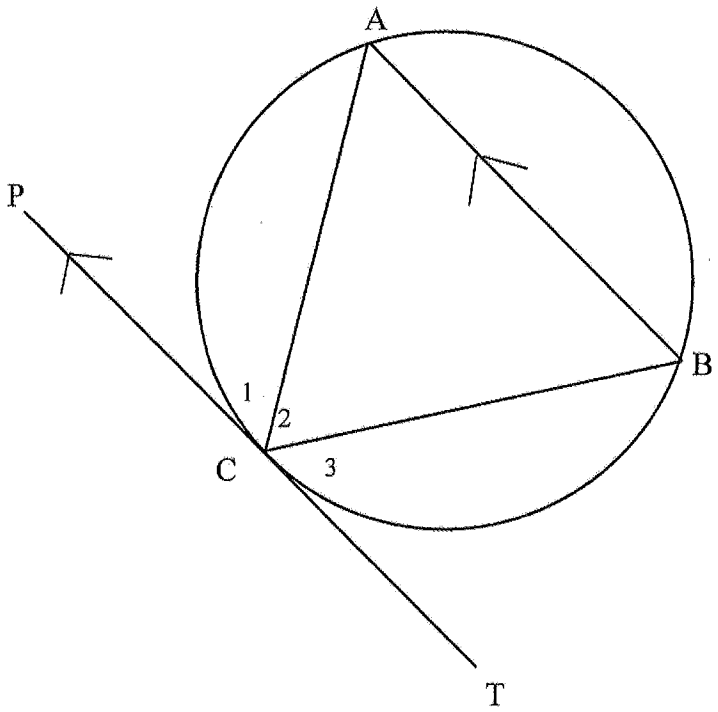
## Question 4.1



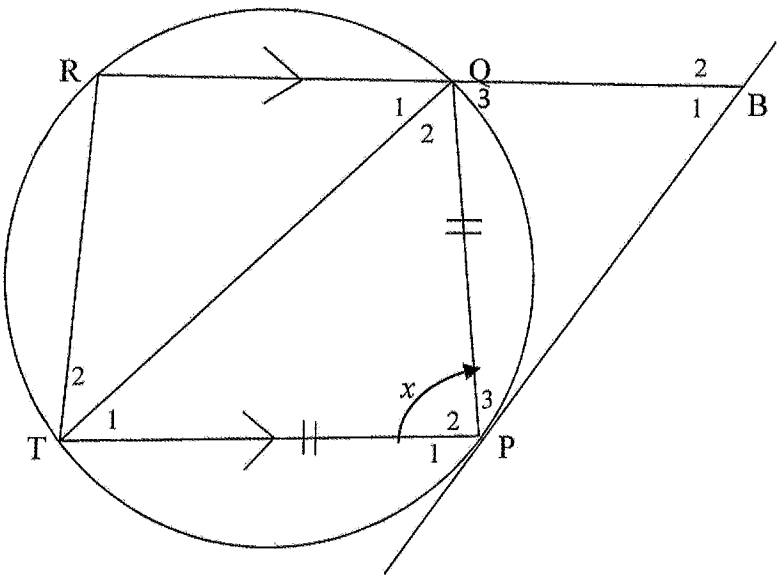

## Question 4.3



## Question 4.4




## Question 5

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# Basic Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

**MATHEMATICS P2**

**JUNE COMMON TEST 2015**

**MEMORANDUM**

**NATIONAL SENIOR CERTIFICATE**

**GRADE 11**

**MARKS: 100**

**This memorandum consists of 9 pages.**



**QUESTION 1**

| | |
|---|---|
| 1.1.1 $AB = \sqrt{(0-8)^2+(8-2)^2}$ ✓<br>$= 10$✓<br>$BC = \sqrt{(8-2)^2+(2+6)^2}$ ✓<br>$= 10$✓ | A: Correct substitution<br>CA: Correct answer (4) |
| 1.1.2 $M = \left(\frac{0+2}{2} \quad \frac{8-6}{2}\right)$ ✓<br>$= (1;1)$ ✓✓ | A: Correct substitution<br>CA: Correct answer (3) |
| 1.1.3 $mBM = \frac{2-1}{8-1}$<br>$= \frac{1}{7}$ ✓<br>$mAC = \frac{8+6}{0-2}$<br>$= -7$✓<br>$\frac{1}{7}x-7 = -1$✓<br>∴ BM is perpendicular to AC✓ | CA Correct substitution into gradient formula.<br>CA: Gradient BM<br>CA: Gradient AC<br>CA: Multiplying gradients (4) |

| | |
|---|---|
| 1.1.4 $mAB = \frac{8-2}{0-8}$<br>$= -\frac{6}{8}$ ✓<br>$mBC = \frac{8}{6}$ ✓<br>$-\frac{3}{4} \times \frac{4}{3} = -1$✓<br>$\therefore \quad A\hat{B}C = 90°$✓ | CA: Gradient CA<br>CA: Gradient CA<br>CA: Multiplying gradients<br>CA: Conclusion (4) |
| 1.1.5 Right✓ – angled - Isosceles✓triangle | A: Right–angled<br>A: Isosceles. (2) |
| 1.1.6 Area $= \frac{10 \times 10}{2}$ ✓<br>$=$ 10 sq units✓ | A: Correct substitution<br>CA: Correct answer. (2) |
| 1.1.7 $y = mx + c$<br>$mBM = \frac{1}{7}$ and M (1:1)<br>$1 = \frac{1}{7}(1) + c$✓<br>$c = \frac{6}{7}$✓<br>$\therefore \quad y = \frac{1x}{7} + \frac{6}{7}$✓<br>**OR**<br>$y - 1 = \frac{1}{7}(x - 1)$✓<br>$y = \frac{1}{7}x + \frac{6}{7}$✓<br>**OR**<br>$y - 2 = \frac{1}{7}x\,(x-8)$ ✓<br>$y = \frac{1}{7}x + \frac{6}{7}$✓ | CA: Correct substitution<br>CA: Correct simplification<br>CA: Correct Answer (3)<br><br>CA: Correct substitution<br>CA: Simplification<br>CA: Correct answer (3)<br><br>CA: Correct substitution<br>CA: Simplification<br>CA: Correct answer. (3) |



| | |
|---|---|
| 1.1.8 $mAC = -7$<br>$mBC = \frac{4}{3}$<br>$\tan\theta = -7$<br>RA $= 81{,}9°$ ✓<br>$\tan\theta = \frac{3}{4}$<br>RA $= 53{,}1°$ ✓<br>$\therefore \quad \theta = 180° - (81{,}9° + 53{,}1°)$<br>$= 45°$✓✓ | CA: 81,9°<br>CA: 53,1°<br>CA: Correct answer (4) |
| 1.1.9 D is (–6✓; 0✓) | CA: Correct answer. (2) |
| | |
| 1.2 $3(-4) + 4(11) = 32$✓<br>$32 = 32$✓<br>$\therefore$ (–4; 11) lies on the line✓ | A: Correct substitution<br>CA: Simplification<br>CA: conclusion. (3) |
| 1.3<br>$mPQ = mRT$<br>$1 \overset{✓}{=} \frac{m+4-\frac{1}{2}}{2m-\frac{5}{2}}$ ✓<br>$2m - \frac{5}{2} = m + \frac{7}{2}$ ✓<br>$m = 6$ ✓ | AA: Equating two gradients<br>CA: Simplification<br>CA: Correct answer. (4) |
| 1.4<br>1.4.1 $\tan 108{,}4° = -3$✓<br>$\therefore \quad m = -3$✓ | A: Correct substitution<br>CA: Correct answer (2) |

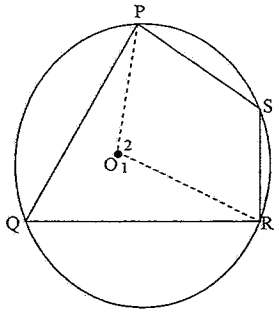
| | |
|---|---|
| 1.4.2 $0 = -3(-3) + c$<br>$c = -9$✓<br>$\therefore \quad y = -3x - 9$✓<br>**OR**<br>$y - 0 = -3(x + 3)$✓<br>$y = -3x - 9$✓ | CA: Correct substitution<br>CA: Correct answer (2)<br>CA: Correct substitution<br>CA: Correct answer (2) |
| 1.4.3 R is $(0; -9)$✓✓ | CA: Correct answer (2) |
| 1.4.4 $\frac{b-0}{a-2a}$✓ $= \frac{b+9}{a-0}$✓<br>$ab = ab + 9a - 2ab - 18a$✓<br>$2ab = -9a$ ✓<br>$b = -\frac{9}{2}$ | AA: Equating two gradients<br>CA: Simplification<br>CA: Correct answer. (4)<br>**[45]** |
| | |
| **QUESTION 2**<br>2.1 bisects the chord✓✓ | AA: Correct answer (2) |
| 2.2<br>2.2.1 DY = 12cm ✓<br>$OD^2 = (12,5)^2 - (12)^2$✓<br>$\therefore$ OD = $\sqrt{12,25}$<br>$\therefore$ OD = 3,5✓<br>$\therefore$ MD = 12,5 – 3,5<br>= 9cm✓ | A: length of DY<br>CA: Correct substitution<br>CA: Length of OD<br>CA: Length of MD (4) |



| | |
|---|---|
| 2.2.2 BD = 12,5 + 3,5<br>= 16✓<br>$BX^2 = XD^2 + BD^2$<br>$= 12^2 + 16^2$✓<br>BX = $\sqrt{400}$ ✓<br>= 20cm✓ | CA: Length of BD.<br>CA: Correct substitution<br>CA: Simplification<br>CA: Correct answer. (4)<br>**[10]** |
| | |
| **QUESTION 3**<br>3.1 twice the size of the angle subtended by the same arc at the circle.✓✓ | AA: Correct answer. (2) |
| | |
| 3.2<br>3.2.1 $O\hat{C}B = 40°$ (OB = OC)✓<br>$B\hat{O}C = 100°$ (int. ∠'s of a triangle)✓<br>$B\hat{A}C = 50°$✓ (∠'at centre)✓ | A: S/R<br>CA: Statement<br>CA: S/R (4) |
| 3.2.2 $B\hat{D}C = 130°$✓ (cyclic quad)✓ | CA: S<br>CA: R (2) |
| 3.2.3 $D\hat{C}B = 25°$✓ (BD = CD)✓ | CA: S<br>CA: R (2)<br>**[10]** |
| | |

**QUESTION 4**

4.1




| | |
|---|---|
| Proof | |
| Construct OP and OR.✓ | A: Construction |
| $\hat{O}_1 = 2P\hat{S}R$ (∠' at centre)✓ | A: Statement & reason |
| $\hat{O}_2 = 2P\hat{Q}R$ (∠' at centre)✓ | A: Statement & reason |
| $\hat{O}_1 + \hat{O}_2 = 360°$ (Revolution)✓ | A: Statement & reason |
| $2P\hat{S}R + 2P\hat{Q}R = 180°$✓ | A: Correct substitution |
| $\therefore\ P\hat{S}R + P\hat{Q}R = 180°$✓ | A: Conclusion |
| **OR** | |
| Let $P\hat{Q}R$ *be* $x$✓ | A: $P\hat{Q}R = x$ |
| $\hat{O}_2 = 2x$ (∠' at centre)✓ | AA: statement and reason |
| $\hat{O}_1 = 360° - 2x$ (Revolution)✓ | A: S/R |
| $P\hat{S}R = 180° - x$ (∠' at centre)✓ | A: S/R |
| $\therefore\ P\hat{Q}R + P\hat{S}R = 180°$✓ | A: conclusion (6) |



| | |
|---|---|
| 4.2 Equal to an angle in the alternate circle segment✓✓ | AA: Correct answer (2) |
| 4.3 | |
| 4.3.1 $A\hat{B}D = 90°$ (diameter)✓ | A: S/R |
| $B\hat{A}D = 28°$ (alt angles of D)✓ | CA: S/R |
| $B\hat{C}D = 152°$✓ (cyclic quad)✓ | CA: S/R (4) |

| | |
|---|---|
| 4.3.2 $B\hat{D}C = 14°$ ✓ (BC = CD)✓<br>$\therefore \quad C\hat{D}F = 14°$ ✓ $(A\hat{D}F = 90°)$✓ | CA: Statement<br>CA: Reason<br>CA: Statement<br>CA: Reason (4) |
| 4.4 $\hat{C}_1 = \hat{A}$ ✓ (alt. ∠'s AB∥ PT)✓<br>$\hat{C}_1 = \hat{B}$ ✓ (Tan – chord)✓<br>$\therefore \quad \hat{A} = \hat{B}$ ✓<br>$\therefore \quad AC = BC$<br>**OR**<br>$\hat{C}_3 \overset{\checkmark}{=} \hat{B}$ (alt ∠s $\overset{\checkmark}{AB} \parallel PT$)<br>$\hat{C}_3 \overset{\checkmark}{=} \hat{A}$ (tan $\overset{\checkmark}{\text{chord}}$)<br>$\therefore \quad \hat{A} = \hat{B}$ ✓<br>$\therefore \quad AC = BC$ | A: Statement<br>A: Reason<br>A: Statement<br>A: Reason<br>A: Conclusion (5)<br>A: Statement<br>A: Reason<br>A: Statement<br>A: Reason<br>A: Conclusion [21] |



| | |
|---|---|
| **QUESTION 5** | |
| 5.1 $\hat{R} = (180° - x)$✓ (cyclic quad)✓ | A: Statement<br>A: Reason |
| 5.2 $\hat{P}_2 \overset{\checkmark}{=} \hat{Q}_2 = x$ $(QT \overset{\checkmark}{=} PT)$<br>$\hat{P}_2 = \hat{Q}_3 \overset{\checkmark}{=} x$ (alt ∠'s $\overset{\checkmark}{RB} \parallel TP$)<br>$\hat{Q}_3 = R\hat{T}P \overset{\checkmark}{=} x$ (ext. ∠' $\overset{\checkmark}{\text{of}}$ cyclic quad)<br>$\hat{Q}_2 = \hat{P}_1 \overset{\checkmark}{=} x$ (tan $\overset{\checkmark}{\text{chord}}$)<br>$\hat{P}_1 = \hat{B}_1 \overset{\checkmark}{=} x$ (corresp. ∠'s RB ∥TP) | A: Statement<br>A: Reason<br>A: Statement<br>A: Reason<br>A: Statement<br>A: Reason<br>A: Statement<br>A: Reason<br>A: Statement<br>A: Reason (10) |
| 5.3 $\hat{Q}_3 = \hat{B}_1$ (proven)✓<br>$\therefore \quad QP = BP$ ✓ | A: Statement<br>A: Conclusion (2)<br>[14] |

**GRADE 11 MATHEMATICS P2 JUNE 2015**

**COGNITIVE LEVEL ANALYSIS GRID SUMMARY**

| LEVEL | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| | KNOWLEDGE | ROUTINE | COMPLEX | PROBLEM SOLVING |
| 1.1.1 | 4 | | | |
| 1.1.2 | | 3 | | |
| 1.1.3 | | 4 | | |
| 1.1.4 | | 4 | | |
| 1.1.5 | 2 | | | |
| 1.1.6 | 2 | | | |
| 1.1.7 | | 3 | | |
| 1.1.8 | | | 2 | |
| 1.1.9 | | 2 | | |
| 1.2 | | 3 | | |
| 1.3 | | | 4 | |
| 1.4.1 | 2 | | | |
| 1.4.2 | | 2 | | |
| 1.4.3 | 2 | | | |
| 1.4.4 | | | 4 | |
| 2.1 | 2 | | | |
| 2.2.1 | | | 4 | |
| 2.2.2 | | | 4 | |
| 3.1 | 2 | | | |
| 3.2.1 | | 4 | | |
| 3.2.2 | | 2 | | |
| 3.2.3 | | 2 | | |
| 4. | | | | 6 |
| 5.1 | 2 | | | |
| 5.2.1 | | | 4 | |
| 5.2.2 | | 4 | | |
| 5.3 | | | 5 | |
| 6.1 | 2 | | | 10 |
| 6.2 | | | | |
| 6.3 | | | 2 | |
| % | 20% | 33% | 31% | 16% |
| | | | | |