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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS
(Second Paper)
NQF LEVEL 3

NOVEMBER EXAMINATION

(10501053)

5 November 2013 (X-Paper)
09:00–12:00

REQUIREMENTS: **1. A non-programmable scientific calculator.**
2. Graph paper.

This question paper consists of 9 pages and 2 formula sheets.

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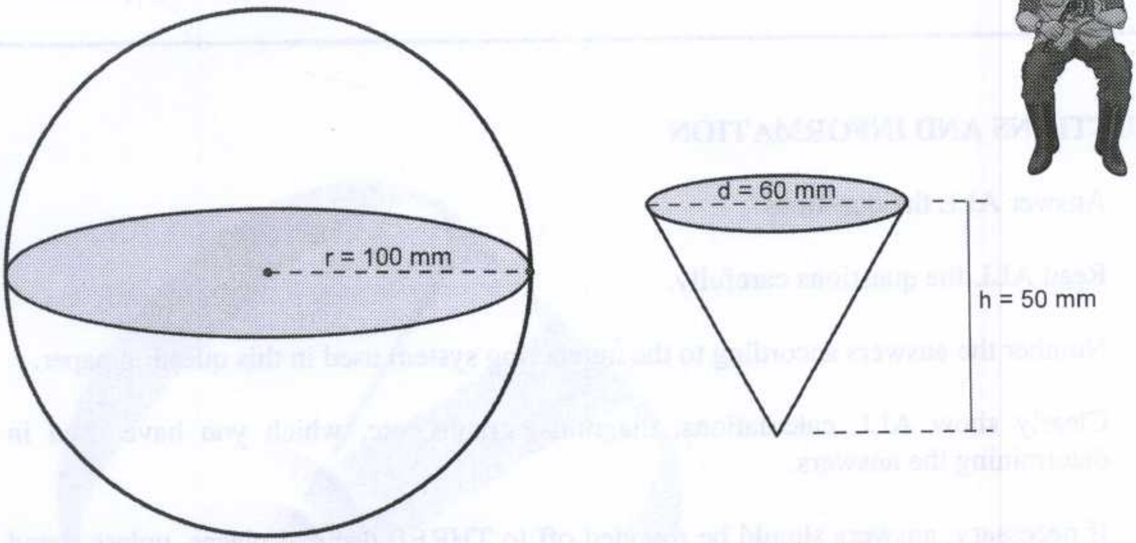
QUESTION 1

1.1 A solid sphere made of lead is to be melted and cast into conical shaped sinkers to be used by fishermen. The sphere has a radius of 100 mm. The cone has a diameter of 60 mm and a vertical height of 50 mm.



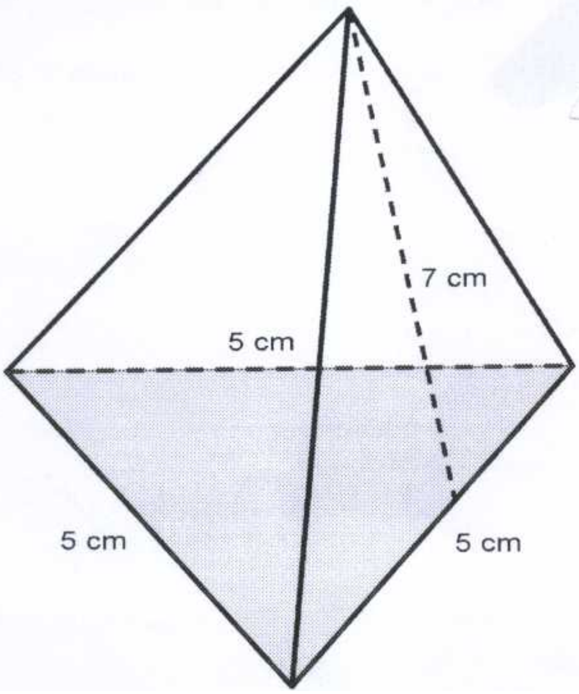
1.1.1 Determine the surface area of the sphere. (2)

1.1.2 Calculate the volume of the sphere. (2)

1.1.3 Determine the volume of one sinker. (2)

1.1.4 Determine the number of sinkers that could be made. (1)

1.2 Given below is a triangular pyramid with an equilateral base of side length 5 cm. The slant height of the pyramid is 7 cm. Calculate the surface area of the triangular pyramid.



(3)

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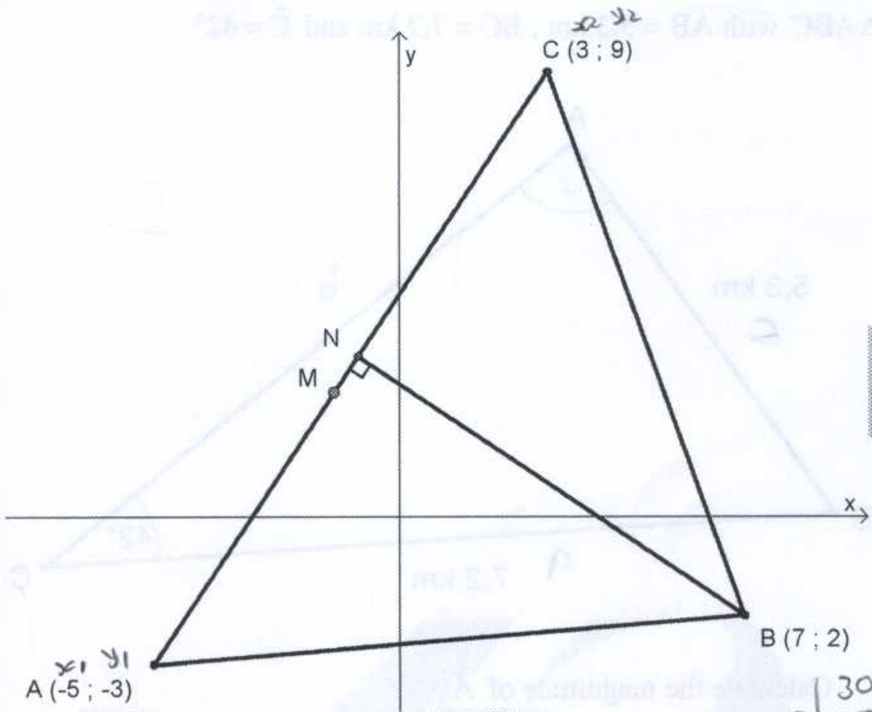
1.3 Determine the volume of a square pyramid with a side length of 6 cm and a perpendicular height of 9 cm. (2)

1.4 A(-5 ; -3), B(7 ; 2) and C(3 ; 9) are the vertices of ΔABC in the Cartesian plane. $BN \perp CA$ and M is the midpoint of AC.



1.4.1 Calculate the length of line segment AC. (2)

1.4.2 Determine the co-ordinates of M, the midpoint of AC. (2)

1.4.3 Calculate the gradient of line segment AC. (2)

1.4.4 Determine the equation of line segment BN. (3)

1.5 The lines $7x+2y=5$ and $-2x+by-18=0$ are perpendicular to each other. Determine the value of b. (4)

[25]

QUESTION 2

2.1 Calculate, without the use of a calculator, the value of:
$2\cos 60° + \sqrt{3}\tan 30° - 2$ (2)

2.2 Prove, without the use of a calculator, that
$$\frac{4\sin 300°.\tan 210°}{\tan 315°} = 2$$ (3)

2.3 Calculate the value/s of θ if $1-2\cos^2\theta = 0$ where $\theta \in [0°;360°]$ (4)

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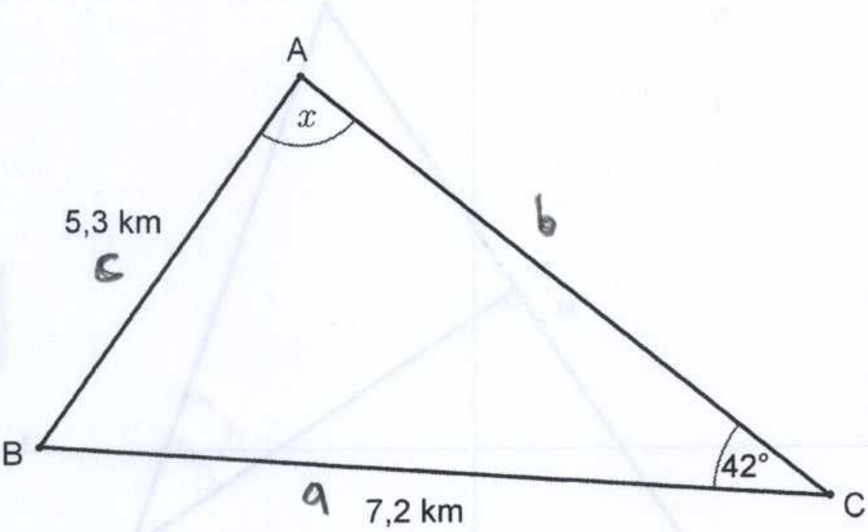
2.4 Make use of trigonometric identities to prove the following:

$$\frac{\sin^4 x + \sin^2 x.\cos^2 x}{1+\cos x} = 1 - \cos x$$ (4)

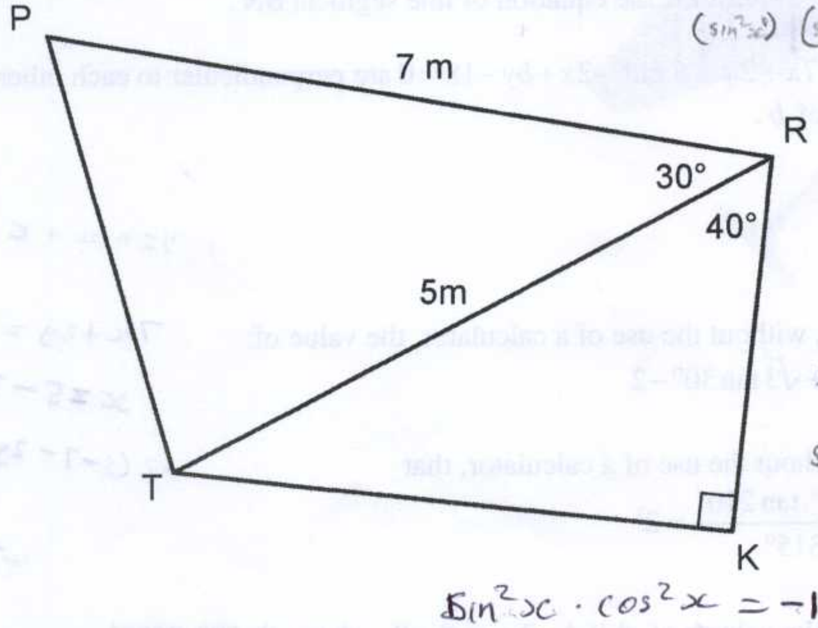
2.5 Given , ΔABC with AB = 5,3 km , BC = 7,2 km and $\hat{C} = 42°$



2.5.1 Calculate the magnitude of $\hat{A}$. (3)

2.5.2 Calculate the perimeter of ΔABC. (3)

2.6 The top view of the 9th hole in a miniature golf circuit is given below.
PR = 7 m, TR = 5 m, $P\hat{R}T = 30°$, $T\hat{R}K = 40°$ and $R\hat{K}T = 90°$.



2.6.1 Calculate the length of KT. (3)

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2.6.2 Use the cosine rule to calculate the length of PT. (3)

[25]

QUESTION 3

3.1 In a soccer match the distance covered by each of the eleven players as they run around on the pitch was measured and recorded as follows:-

Player	Distance(km.)
1	2,8
2	10,0
3	9,1
4	8,3
5	8,2
6	9,7
7	9,3
8	8,4
9	10,2
10	9,6
11	9,3

3.1.1 Determine the median distance covered. (1)

3.1.2 Determine the upper and lower quartiles of the distances covered. (2)

3.1.3 Determine the upper and lower fence values. (2)

3.1.4 Construct a box and whisker diagram for the above information showing any outliers. Give a possible reason for the outlier. (5)

3.2 One hundred pebbles from the beach are collected and their lengths are measured. The length of the smallest pebble is 1 mm and the largest is 95 mm. The class width of the classes is 20 mm. The lengths of the 100 pebbles are summarised in the table below:

Classes (Length in mm.)	Frequency (f_i)
0 – < 20	9
20 – < 40	24
40 – < 60	41
60 – < 80	20
80 – < 100	6
Total	100

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3.2.1 Copy and complete the following frequency distribution table in your ANSWER BOOKS. The first row has been done for you. The class width (c) is 20.

Classes (length in mm.)	Frequency (f_i)	Midpoint (x_i)	$f_i x_i$	< Cumulative frequency
0 – < 20	9	10	90	9
20 – < 40	24	30		
40 – < 60	41	50		
60 – < 80	20	70		
80 – < 100	6	90		
Total	100		$\sum f_i x_i =$	

(6)

Use the table in QUESTION 3.2.1 to answer the following questions:

3.2.2 Calculate the mean of the lengths of the pebbles. (2)

3.2.3 Calculate the mode. (3)

3.2.4 Calculate the median length by first calculating the median position. (3)

3.2.5 Use the supplied graph paper to sketch the ogive curve using the less than cumulative frequency and the upper class limit. (5)

[29]

QUESTION 4

4.1 Study the information provided and write down only the answers next to the question numbers (4.1.1 – 4.1.7) in the ANSWER BOOK.

Quickstep Dancing and Social Club is a club where members meet once a week to socialise and to learn how to dance.

The club was <u>expected</u> to receive the following amounts of money for the year ended 31 October 2013: -

Membership fees	R 15 000
Sponsorships	8 000
Donations	5 500
	R 28 500

The club was <u>expected</u> to have the following expenditure for the same year:-

Rent	R 1 500
Water and Light	1 200
Telephone	800
Honorarium	1 500
Catering	7 000
Prize-giving function	5 000
Year-end function	6 700
Refreshments	2 300
Surplus	2 500
	R 28 500

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Listed below is the actual income and expenditure of the club for the year ended 31 October 2013:-

Income	
Membership fees	R 14 500
Sponsorships	9 000
Donations	5 500
	R 29 000
Expenditure	
Rent	R 1 500
Water and Light	1 200
Telephone	800
Honorarium	1 500
Catering	7 600
Prize-giving function	5 000
Year-end function	6 300
Refreshments	2 200
Surplus	2 900
	R 29 000

ITEM	BUDGETED AMOUNT	ACTUAL AMOUNT	VARIANCE
INCOME			
Membership fees	15 000	(4.1.1)	-500
Sponsorships	8 000	9 000	(4.1.2)
Donations	5 500	5 500	0
TOTAL	(4.1.3)	29 000	+500
EXPENSES			
Rent	1 500	1 500	0
Water and Light	1 200	1 200	0
Telephone	800	800	0
Honorarium	1 500	1 500	0
Catering	7 000	7 600	(4.1.4)
Prize-giving function	5 000	5 000	0
Year-end function	(4.1.5)	6 300	+400
Refreshments	2 300	2 200	(4.1.6)
TOTAL	26 000	(4.1.7)	-100
SURPLUS/DEFICIT	2 500	2 900	+400

(7)

4.2 Kanye has a 1 year old child. He has R25 000 which he wants to invest in order to send his child to school in 5 years' time.

Good Money Bank offers him the following rates of interest :-
OPTION 1 : 9 % p.a. **Simple** interest
OPTION 2 : 8 % p.a. **Compound** interest (compounded monthly)

Which investment option would you advise Kanye to choose? (Show all calculations) (4)

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4.3 Wandile is a very wise and thrifty person. She tries to invest the money that she has saved in a long-term investment plan.

♪ She started off with an amount of R55 000 for which she earned an interest rate of 10% p.a. **simple** interest.

♪ **Three** years later she invests R10 000 into the same account. The bank now offers her an interest rate of 11% p.a. interest **compounded annually**.

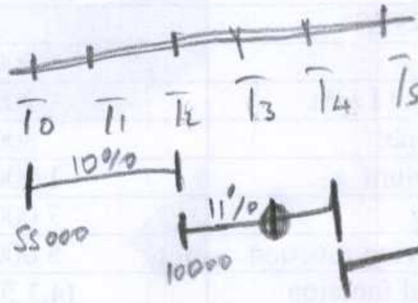
♪ **Two** years after this she invests an additional amount of R 15 000 at an interest rate of 11,5% p.a. **compounded** semi-annually.

4.3.1 Show the timeline for the above investment. (3)

4.3.2 Determine the total amount of money that Wandile would have saved after 6 years. (7)

[21]

TOTAL: 100



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FORMULAE SHEET

1. Slant surface area of a pyramid = $\frac{1}{2}aln$ or $\frac{1}{2}lh_s n$ (where n = number of sides)
2. Surface area of triangular pyramid = $\frac{1}{2}bh+\frac{1}{2}pl$ where p=perimeter of the base.
3. Surface area of a pyramid with an equilateral triangle as base = $\frac{\sqrt{3}}{4}s^2+\frac{1}{2}pl$
4. Surface area of an equilateral triangular pyramid = $4\times\frac{\sqrt{3}}{4}s^2$
5. Surface area of square pyramid = $b^2+\frac{1}{2}pl$
6. Surface area of a regular hexagonal pyramid = $\frac{3\sqrt{3}}{2}b^2+\frac{1}{2}pl$
7. Volume of a pyramid = $\frac{1}{3}$(area of base) $\times\perp$ height
8. $s=\frac{1}{2}(a+b+c)$ *and a,b,c are the sides of the triangle*
9. $A=\sqrt{s(s-a)(s-b)(s-c)}$
10. Circumference of circle = $2\pi r$
11. Area of curved surface of a cone = $\pi r l$ or $\pi r h_s$
12. Slant height of a cone = $l=\sqrt{h^2+r^2}$ or $h_s=\sqrt{_\perp h^2+r^2}$
13. Volume of cone = $V_{cone}=\frac{1}{3}\pi r^2 \times_\perp h$
14. Area of a sphere = $A=4\pi r^2$
15. Volume of a sphere = $V=\frac{4}{3}\pi r^3$
16. $m=\frac{\Delta y}{\Delta x}=\frac{y_2-y_1}{x_2-x_1}$
17. $(x_m\,;y_m)=\left(\frac{x_1+x_2}{2}\,;\frac{y_1+y_2}{2}\right)$
18. $\theta=\tan^{-1} m$
19. Distance = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
20. $\frac{\sin\theta}{\cos\theta}=\tan\theta$
21. $\sin^2\theta+\cos^2\theta=1$
22. $\frac{\sin A}{a}=\frac{\sin B}{b}=\frac{\sin C}{c}$

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23. $a^2 = b^2 + c^2 - 2bc \ \cos \hat{A}$

24. $A = \frac{1}{2} ab \sin \hat{C}$

25. $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$

26. $\bar{x} = \frac{\sum f_i x_i}{n}$

27. $Q_{j\ position} = \frac{j}{4}(n+1)$

28. $Q_i = Q_3 - Q_1$

29. Fence = $Q_3 + 1{,}5(Q_i)$

30. Fence = $Q_1 - 1{,}5(Q_i)$

31. $Me = l + \frac{\left(\frac{n}{2} - F\right)}{f} \times c$

32. $Mo = l + \frac{f_m - f_{m-1}}{2f_m - f_{m-1} - f_{m+1}} \times c$

33. $I = A_0 \times \frac{r}{100} \times t$ or $I = \frac{Prt}{100}$ or $A_t = P(1+in)$

34. $A_t = A_0 \left(1 + \frac{r}{100 \times m}\right)^{t \times m}$ or $A_t = P(1+i)^n$

35. $A_t = A_o (1 - \frac{r}{100})^t$ or $A_t = P(1-i)^n$

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