higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS
(Second Paper)
NQF LEVEL 3

NOVEMBER 2012

(10501053)

6 November (X-Paper)
09:00 – 12:00

REQUIREMENTS: Graph paper.

This question paper consists of 8 pages and a 2-page formula sheet.

Please turn over

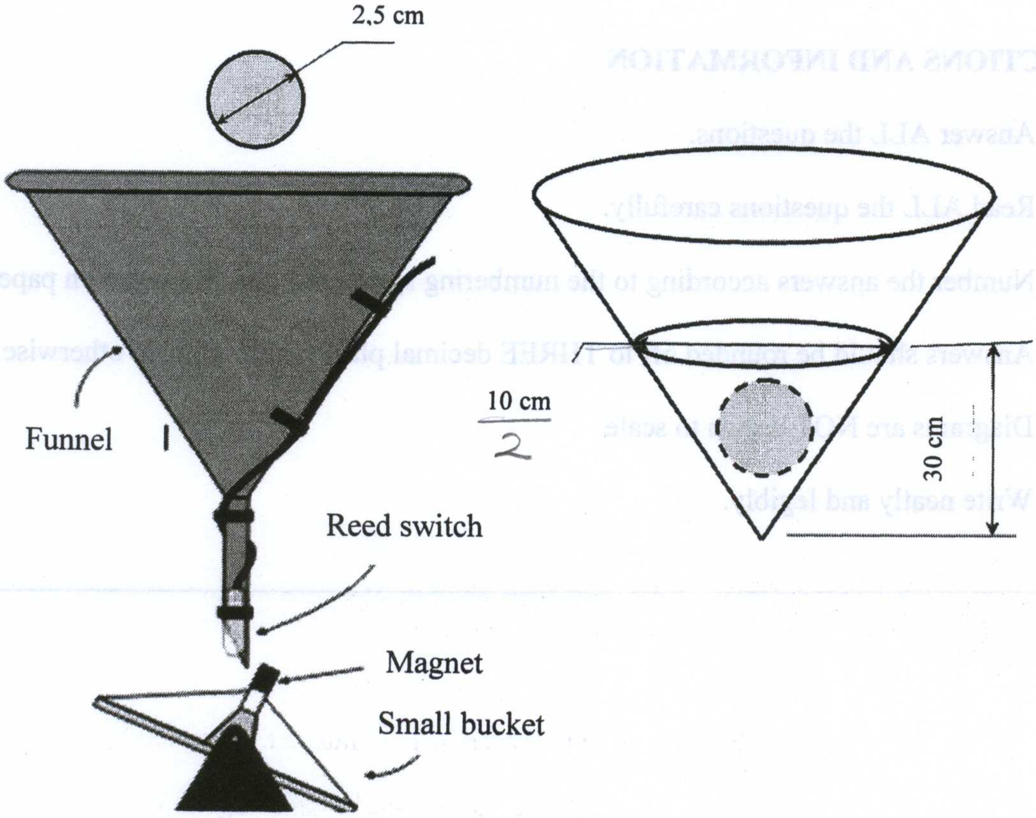
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Answers should be rounded off to THREE decimal places, unless stated otherwise.
5. Diagrams are NOT drawn to scale.
6. Write neatly and legibly.

QUESTION 1

1.1 In South Africa the heaviest average rainfall, up to 1778 mm, is experienced in the province of KwaZulu-Natal. The diagram below shows a rain gauge that is used to measure the rainfall. The funnel of the rain gauge is in the shape of a cone.



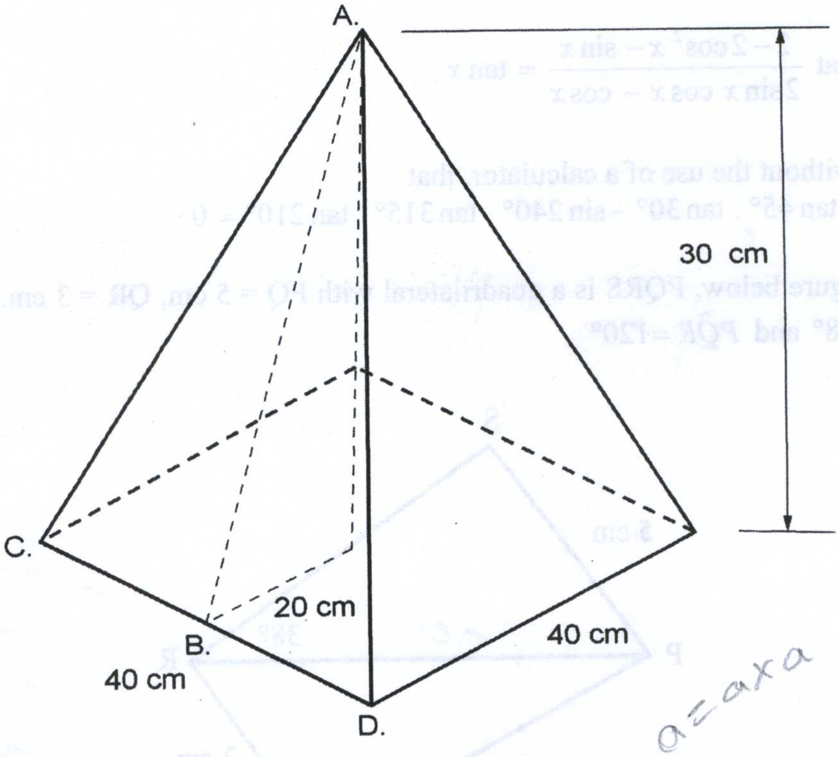
On one of the rainy days an orange of diameter 2,5 cm falls into the funnel causing the water in the funnel to rise up to 30 cm. The diameter of the water at that height is 10 cm. Study the figures above and answer the following questions:

1.1.1 Determine the volume of the orange. (3)

1.1.2 Determine the amount of water inside the rain gauge after the orange has fallen in. (5)

1.1.3 Determine the total surface area of the conical section of the funnel if the diameter of the top section is 60 cm and the vertical height is 50 cm. (7)

1.2 Given below is a square pyramid with a side length of 40 cm and a vertical height of 30 cm.



1.2.1 Use the theorem of Pythagoras to calculate the slant height AB. (2)

1.2.2 Determine the slant surface area of the square pyramid. (2)

1.2.3 Calculate the area of the base of the square pyramid. (1)

1.2.4 Determine the total surface area of the square pyramid. (1)

1.3 Determine the equation of the line CD, parallel to the line $-2y+x=2$ and passing through the point (-2; 4). (4)

[25]

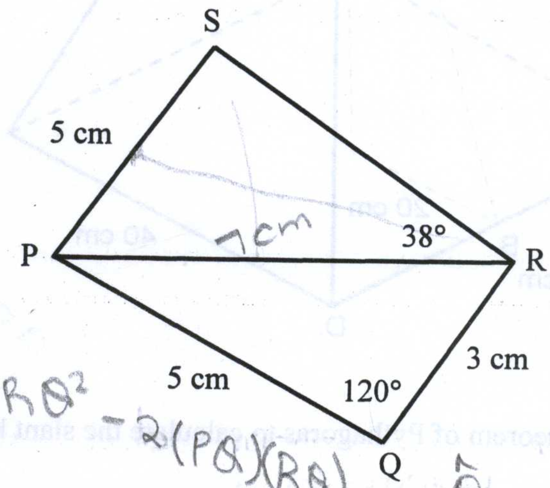
QUESTION 2

2.1 Calculate the value of θ if $4\sin^2\theta - 4 = -1$ for $0^0 \le \theta \le 360^0$ (5)

2.2 Prove that $\dfrac{2-2\cos^2 x - \sin x}{2\sin x\,\cos x - \cos x} = \tan x$ (5)

2.3 Prove, without the use of a calculator, that
$\sin 60°.\ \tan 45°\ .\ \tan 30° - \sin 240°\ .\ \tan 315°\ .\ \tan 210° = 0$ (5)

2.4 In the figure below, PQRS is a quadrilateral with PQ = 5 cm, QR = 3 cm, PS = 5 cm, $P\hat{R}S = 38°$ and $P\hat{Q}R = 120°$



2.4.1 Calculate the length of line segment PR (4)

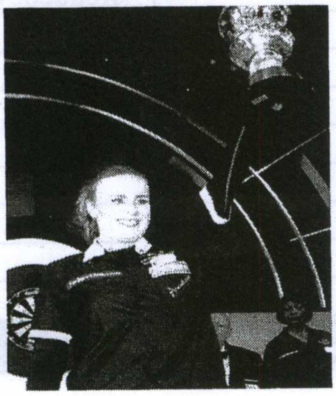
2.4.2 Calculate the magnitude of $\hat{S}$ (3)

2.4.3 Determine the area of ΔPQR (3)

[25]

QUESTION 3

3.1 Russian Anastacia Dobromyslova was crowned dart champion of the world for the second time running. Her scores in the last ten rounds were as follows:



75
89
180
114
90
120
110
80
98
4

3.1.1 Determine her median score. (2)

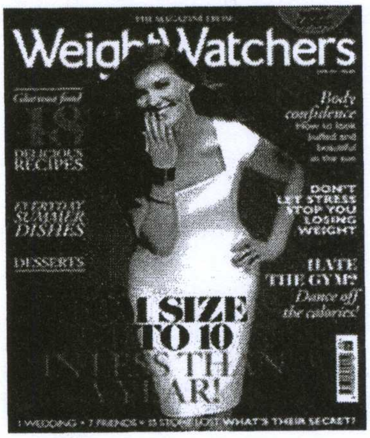
3.1.2 Determine the upper and lower quartiles of her scores. (4)

3.1.3 Determine the upper and lower fence values. (4)

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

3.2 Obesity is a contributing factor to the mortality rate in South Africa. A local Weight Watchers club compiled a frequency distribution table for its 50 members. Given below is a table that shows the masses of the members.

Classes (Masses)	Frequency (f_i)
79 – 89	4
90 – 100	8
101 – 111	7
112 – 122	8
123 – 133	2
134 – 144	4
145 – 155	10
156 - 166	7
Total	50



3.2.1 Copy and complete the following frequency distribution table in your ANSWER BOOK.

Classes (Masses)	Frequency (f_i)	Midpoint (x_i)	$f_i x_i$	< Cumulative frequency
79 – 89	4			
90 – 100	8			
101 – 111	7			
112 – 122	8			
123 – 133	2			
134 – 144	4			
145 – 155	10			
156 - 166	7			
Total	50		$\sum f_i x_i =$	

(4)

Use the table in QUESTION 3.2.1 to answer the questions.

3.2.2 Calculate the mean mass. (2)

3.2.3 Calculate the mode. (2)

3.2.4 Calculate the median mass 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. (4)

[30]

QUESTION 4

4.1 The table below shows how the SRC tracks its annual budget and how the money was spent up to the end of 2011. Study the table below and write only the answers for QUESTIONS 4.1.1 to 4.1.8 next to the question numbers in the ANSWER BOOK.

ITEM	BUDGETED AMOUNT	ACTUAL AMOUNT	VARIANCE
INCOME	**R165 000**	**R168 000**	**+ R3 000**
EXPENSES			
Valentine's day	10 000	11 000	- 1 000
Cultural activities	**(4.1.1)**	65 000	**(4.1.2)**
Administration	10 000	10 000	**(4.1.3)**
Sports day	30 000	**(4.1.4)**	+5 000
Educational tours	50 000	36 000	**(4.1.5)**
TOTAL	**R160 000**	**R147 000**	**(4.1.6)**
SURPLUS/DEFICIT	**(4.1.7)**	R21 000	**(4.1.8)**

(8)

4.2 Linda invested R5 000 into a savings account that offered her interest at a rate of 9,5% compounded quarterly for a period of 3 years. Determine the value of her investment after 3 years. (4)

4.3 Mr Nkosi is saving for his son's university education and he decides to put his money into a savings account. He invests R4 200 into the savings account where the interest rate for the first 7 years is 8% simple interest. After 3 years he deposits another R3 000 into the savings account at an interest rate of 8% simple interest. A final deposit of R2 000 is made for the last 2 years of the investment where the interest rate has increased to 10% compounded annually.

4.3.1 Show the time line for the above investment. (2)

4.3.2 Determine the value of the investment after 9 years. (6)

[20]

TOTAL: 100

FORMULAE SHEET

1. Slant surface area of a pyramid = $\frac{1}{2} a l n$
2. Volume of a pyramid = $\frac{1}{3}$(area of base) $\times \perp$ height
3. $s = \frac{1}{2}(a + b + c)$ *and a, b, c are the sides of the triangle*
4. $A = \sqrt{s(s-a)(s-b)(s-c)}$
5. Circumference of circle = $2\pi r$
6. Area of curved surface of a cone = $\pi r l$
7. Slant height of a cone = $l = \sqrt{h^2 + r^2}$
8. Volume of cone = $V_{cone} = \frac{1}{3}\pi r^2 h$
9. Area of a sphere = $A = 4\pi r^2$
10. Volume of a sphere = $V = \frac{4}{3}\pi r^3$
11. $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$
12. $(x_m ; y_m) = \left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$
13. $\theta = \tan^{-1} m$
14. Distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
15. $\frac{\sin\theta}{\cos\theta} = \tan\theta$
16. $\sin^2\theta + \cos^2\theta = 1$
17. $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$
18. $a^2 = b^2 + c^2 - 2bc \cos\hat{A}$
19. $A = \frac{1}{2} ab \sin\hat{C}$

20. $\bar{x} = \dfrac{\sum_{i=1}^{n} x_i}{n}$

21. $\bar{x} = \dfrac{\sum f_i x_i}{n}$

22. $Q_{j\ position} = \dfrac{j}{4}(n+1)$

23. $Q_i = Q_3 - Q_1$

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

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

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

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

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

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

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