higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS
(Second Paper)
NQF LEVEL 3

SUPPLEMENTARY EXAMINATION

(10501053)

7 March 2014 (X-Paper)
09:00–12:00

REQUIREMENTS: Graph paper

A nonprogrammable scientific calculator may be used.

This question paper consists of 9 pages and 1 formula sheet of 3 pages.

TIME: 3 HOURS
MARKS: 100

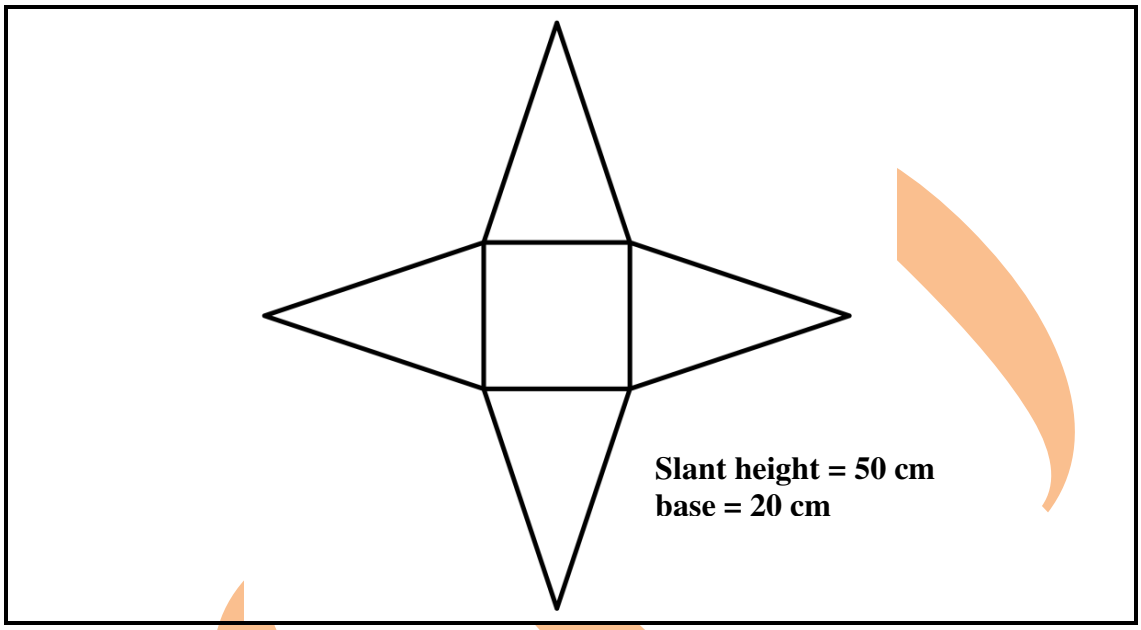
INSTRUCTIONS AND INFORMATION

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. Clearly show ALL calculations, diagrams, graphs, et cetera., which you have used in determining the answers.
5. If necessary, answers should be rounded off to THREE decimal places, unless stated otherwise.
6. Diagrams are NOT drawn to scale.

QUESTION 1

1.1 FIGURE 1 represents the net of a box in the shape of a right pyramid with a square base. It has a base length of 20 cm and a slant height of 50 cm.

Calculate the surface area of the box.

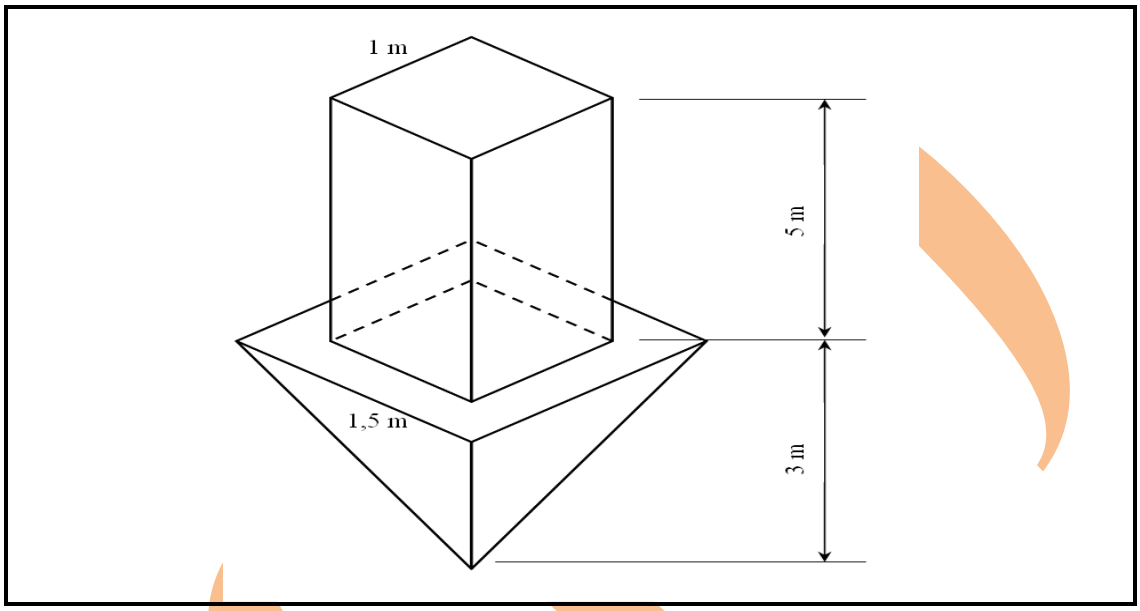


(3)

FIGURE 1

1.2 A structural steel engineering company has received an order for 10 solid steel structures as shown in FIGURE 2 below. The structure comprises a rectangular prism on top of an inverted pyramid. The rectangular prism has a square base of 1 metre and a height of 5 metres. The pyramid has a square base of 1,5 metres and a vertical height of 3 metres.

Use the diagram below to answer the questions.



FIGUUR 2

1.2.1 Calculate the total amount of steel required to manufacture the structures. (5)

1.2.2 Calculate the cost of the steel at R250 per cubic metre. (2)

1.3 R (–4;2) and T (2;4) are points in the Cartesian plane in FIGURE 3. M is the midpoint of RT.

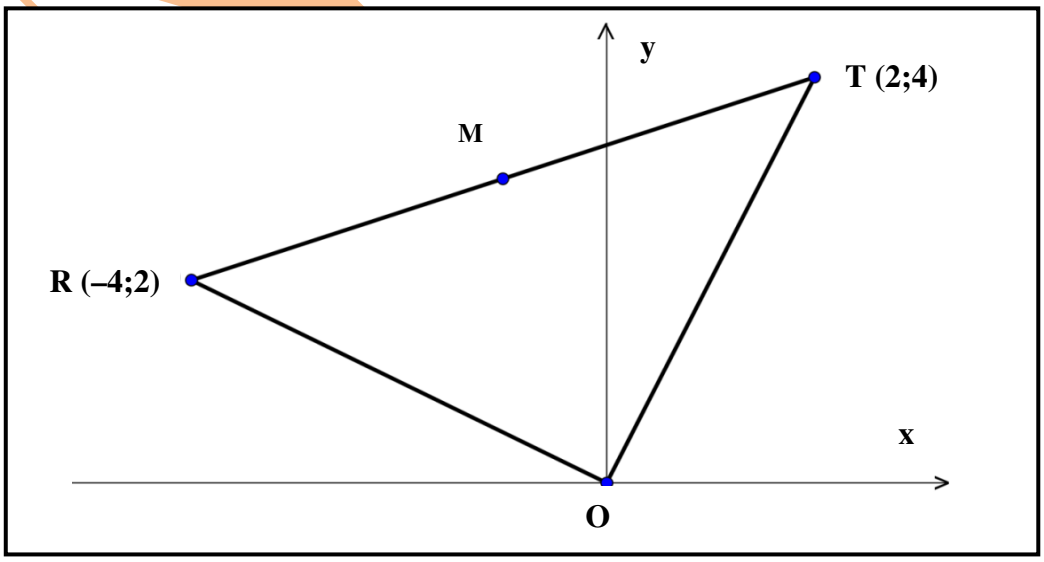


FIGURE 3

1.3.1 Calculate the length of RT. (2)

1.3.2 Calculate the co-ordinates of M, the midpoint of RT. (2)

1.3.3 Write down the equation of OM. (2)

1.3.4 Show by calculation that ΔROT is a right-angle triangle. (3)

1.4 A (2;3) and C (5;–3) are points in the Cartesian plane in FIGURE 4. Line segment EF is parallel to line segment AC and cuts the *x*-axis at (5;0).

1.4

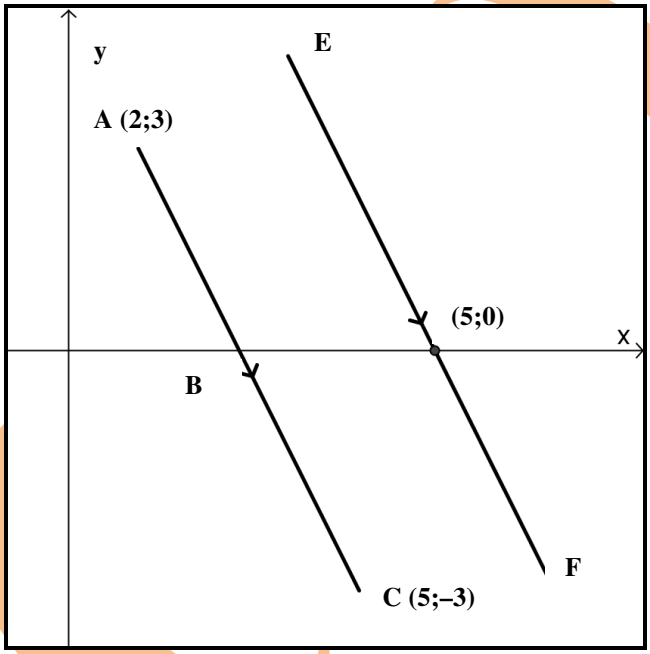


FIGURE 4

1.4.1 Calculate the gradient of AC. (2)

1.4.2 Determine the equation of line segment EF (3)

[24]

QUESTION 2

2.1 If $\cos^2 A = \frac{16}{25}$, and $0° \leq A \leq 90°$, calculate the following:

2.1.1 $\cos A$ (1)

2.1.2 $\tan(180° - A)$ (2)

2.1.3 $\cos^2(180° - A) + \sin^2(180° - A)$ (3)

2.2 Prove, without the use of a calculator, that :

$$\frac{\sin 210° \cos 150° \tan 315°}{\sin 120°} = -\frac{1}{2}$$ (3)

2.3 Write $\tan^2 x$ in terms of $\sin x$ and $\cos x$. (1)

2.4 Using the answer to QUESTION 2.3 above, prove that $\cos^2 x(1+\tan^2 x)=1$ (3)

2.5 Calculate the value/s of x that will satisfy the equation:

$3\tan x + 5 = 0$ for $0° \leq x \leq 360°$ (4)

2.6 In ΔABD in FIGURE 5 below $DA \perp AB$ and $AH \perp BD$.
AB = 10 cm and $\hat{B} = 23°$

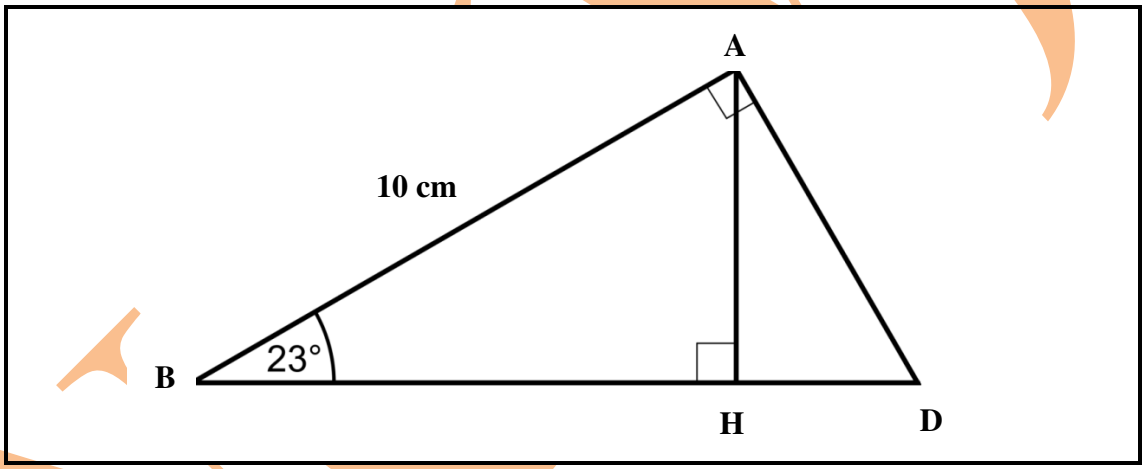


FIGURE 5

2.6.1 Calculate the length of AH. (2)

2.6.2 Calculate the length of HD. (2)

2.7 FIGURE 6 below represents a farm in the shape of a quadrilateral. A fence from point B to point D divides the farm into two sections. AD = 11 km and DC = 15 km. $D\hat{A}B = 102°$; $\hat{D}_2 = 41°$ and $A\hat{D}C = 75°$.

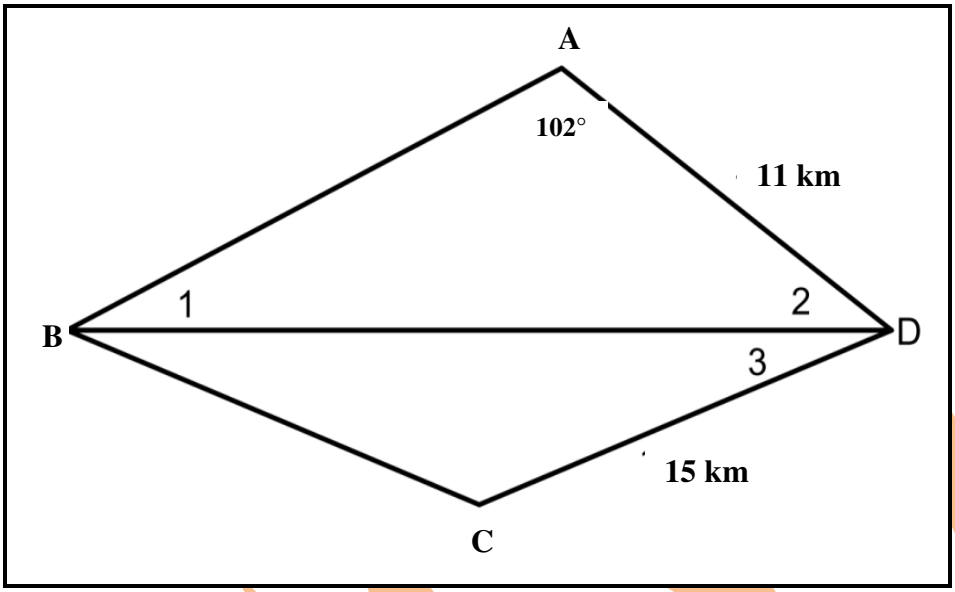


FIGURE 6

Use the diagram above to calculate the following:

2.7.1 The magnitude of angle $\hat{B}_1$ (1)

2.7.2 The length of the fence (2)

2.7.3 The length of BC (2)

[26]

QUESTION 3

3.1 The data below is organised on a stem and leaf plot and represents the number of cars passing through an intersection between 16:00 and 20:00 over a 17-day period.

0	2
1	2 5 5 7 8 8 9
2	0 1 2 4 5 6 7 8 8

Use the given stem and leaf plot to determine the following:

3.1.1 The median (1)

3.1.2 The upper and lower quartiles (2)

3.1.3 The upper and lower fence (2)

3.1.4 Construct a box and whisker diagram for the above showing any outliers. (4)

3.2 The time taken (to the nearest minute) for a certain task to be completed was recorded on 50 occasions and the following data was obtained. The class width of the classes is 5.

Time t (in minutes)	**Frequency** (f_i)	**Midpoint** (x_i)	$f_i x_i$	**Cumulative frequency**
11–< 16	6	13	78	6
16–< 21	9	18		
21–< 26	17	23		
26– < 31	13	28		
31– < 36	5	33		
Total	50		$\sum f_i x_i =$	

3.2.1 Copy and complete the table in the ANSWER BOOK. The first row has been done. (6)

3.2.2 Calculate the mean. (3)

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 The table below reflects the **actual** income and expenditure as compared to the **budgeted** income and expenditure of Madadeni Social Club for the year ended 31 December 2013.

Study the table and complete it by filling in the missing information. Write only the answer next to the question number (4.1.1–4.1.7) in the ANSWER BOOK.

ITEM	BUDGETED AMOUNT	ACTUAL AMOUNT	VARIANCE
INCOME	**R120 000**	**122 000**	**4.1.1**
EXPENSES			
Rent	12 000	12 000	**4.1.2**
Telephone	1 200	**4.1.3**	-700
Administration	5 900	6 200	**4.1.4**
Sports day	**4.1.5**	18 000	+1 400
Excursions	46 700	49 000	-2 300
Cultural activities	30 500	26 200	+4 300
TOTAL	**115 700**	**4.1.6**	**+2 400**
SURPLUS/DEFICIT	**4.1.7**	**8 700**	**+4 400**

(7)

4.2 Anesh needs R70 000 to start a business. The loan will be paid in 5 years' time when one of his investments matures.

He has 2 options:

1. Borrow the money from his dad at 12% p. a. **simple interest.**

2. Borrow the money from a bank at an interest rate of 10,8% p.a. **compounded** monthly.

Indicate which one is the cheaper option and calculate the amount of money that Anesh will save if he chooses the cheaper option. (5)

4.3 R120 000 was invested in the bond market for 5 years. The interest was fixed at 11,8% p.a. **compounded quarterly** for the first 3 years and then changed to 10% p.a. **compounded semi-annually**. ONE **withdrawal** of R40 000 was made after the first 2 years.

4.3.1 Show the time line for the above investment. (3)

4.3.2 Calculate the amount of money that was available after 5 years. (6)

[21]

TOTAL: 100

FORMULA SHEET

1. Slant surface area of a pyramid = $\frac{1}{2}a\,l\,n$ or $\frac{1}{2}l\,h_s\,n$ (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. $(x_m\,;y_m)=\left(\dfrac{x_1+x_2}{2}\,;\dfrac{y_1+y_2}{2}\right)$

18. $\theta=\tan^{-1}\ m$

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

20. $\dfrac{\sin\theta}{\cos\theta}=\tan\theta$

21. $\sin^2\theta+\cos^2\theta=1$

22. $\dfrac{\sin A}{a}=\dfrac{\sin B}{b}=\dfrac{\sin C}{c}$

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

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

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

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

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

28. $Q_i=Q_3-Q_1$

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

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

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

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

33. $I = A_0 \times \frac{r}{100} \times t$ or $I = \frac{P\,r\,t}{100}$ 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 $A_t = P(1 - i)^n$