higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS
(Second Paper)
NQF LEVEL 2

(10501042)

23 February 2018 (X-Paper)
09:00–12:00

Candidates may use a nonprogrammable scientific calculator and a protractor.

This question paper consists of 8 pages, a formula sheet of 2 pages and 2 addenda.

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.

        Clearly show ALL calculations, diagrams, graphs, etc. used to determine the answers.

4.
        Answers should be rounded to THREE decimal places, unless stated otherwise.

5.   Diagrams are NOT drawn to scale.

        Write neatly and legibly.

6.

7.

QUESTION 1

1.1 The circle-graph given below shows the spending of a country on various sports during a particular year.
Study the graph carefully and answer the questions.
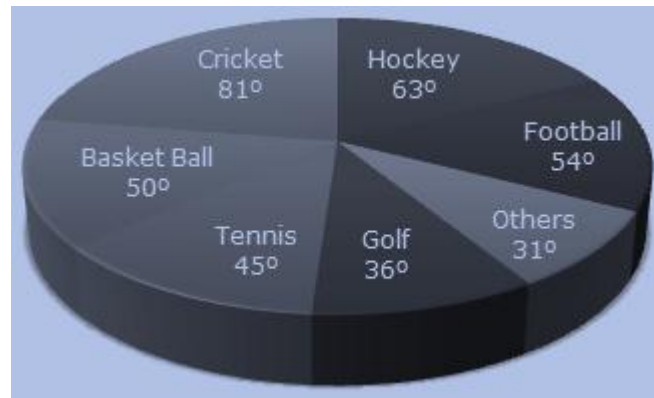
1.1.1 What is the mathematical name for this kind of graph? (1)

1.1.2 On which sport does this country spend most of this money ? (1)

1.1.3 What percentage of the money is spent on golf? (2)

1.2 The following are the masses of all the under-15 boys playing soccer at Francis High School rounded to the nearest kg:

27 35 42 35 36 51 43 30 51 37 36
37 42 46 41 26 42 35 34 39 36 42
35 41 36 37 37 45 46 44 36 46 36
40 48

1.2.1 Draw a stem-and-leaf diagram to sort this data. (5)

1.2.2 Calculate the mean mass of the boys. (3)

1.2.3 Determine the median of the masses. (1)

1.2.4 Write down the mode for the masses of the boys. (1)

1.2.5 Calculate the range of the masses. (2)

1.3 The following data is given:

33 23 19 39 68 37 7 45 19 40 37 43 28

1.3.1 Write down the minimum value. (1)

1.3.2 Determine the lower quartile of the given data. (2)

1.3.3 Determine the upper quartile of the given data. (2)

1.3.4   Calculate the interquartile range for the given data.   (2)

1.3.5   Determine the semi-interquartile range for the given data.   (1)

1.4   A teacher recorded the mathematics year marks for a grade 9 class. The marks are given as percentages:

45 71 85 65 90 30 80 25 71 35 62 60 54 72 48 55 50 72 83 50 75

     1.4.1   Use the ADDENDUM A (attached) to complete the following distribution table:

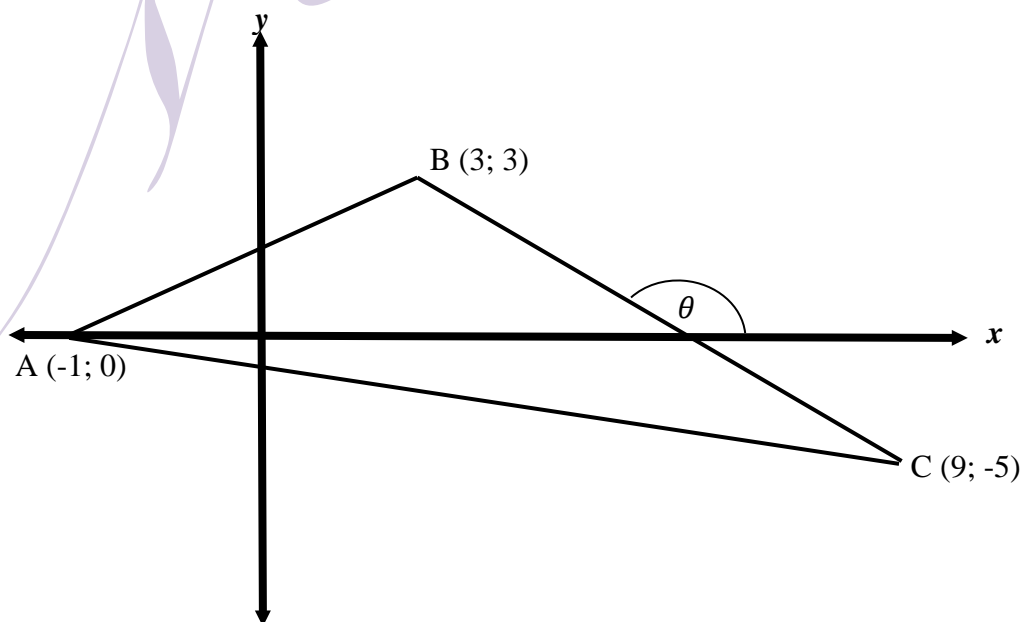| Marks intervals	Tally	Frequency
20 – 29		
30 – 39		
40 – 49		
50 – 59		
60 – 69		
70 – 79		
80 – 89		
90 – 99		
Total:		21

         (8)

     1.4.2   Draw a bar graph on the ADDENDUM A (attached) using information from QUESTION 1.4.1.   (8)

[40]

QUESTION 2

2.1   A(-1;0), B(3;3) and C(9;-5) are the vertices of ΔABC.

     2.1.1   Calculate the length of AB.   (3)

2.1.2   Calculate the gradient of AB.   (2)

2.1.3   Calculate the midpoint of AB.   (2)

2.1.4   If BC is perpendicular to AB, calculate the area ΔABC.   (4)

2.1.5   Determine the equation of line AC.   (5)

2.1.6   Calculate the value of θ, (the inclination of line BC), correct to THREE
          decimal places, by making use of the arctan of the gradient.   (3)

2.2   In the diagram Δ ABC is drawn in the Cartesian plane.
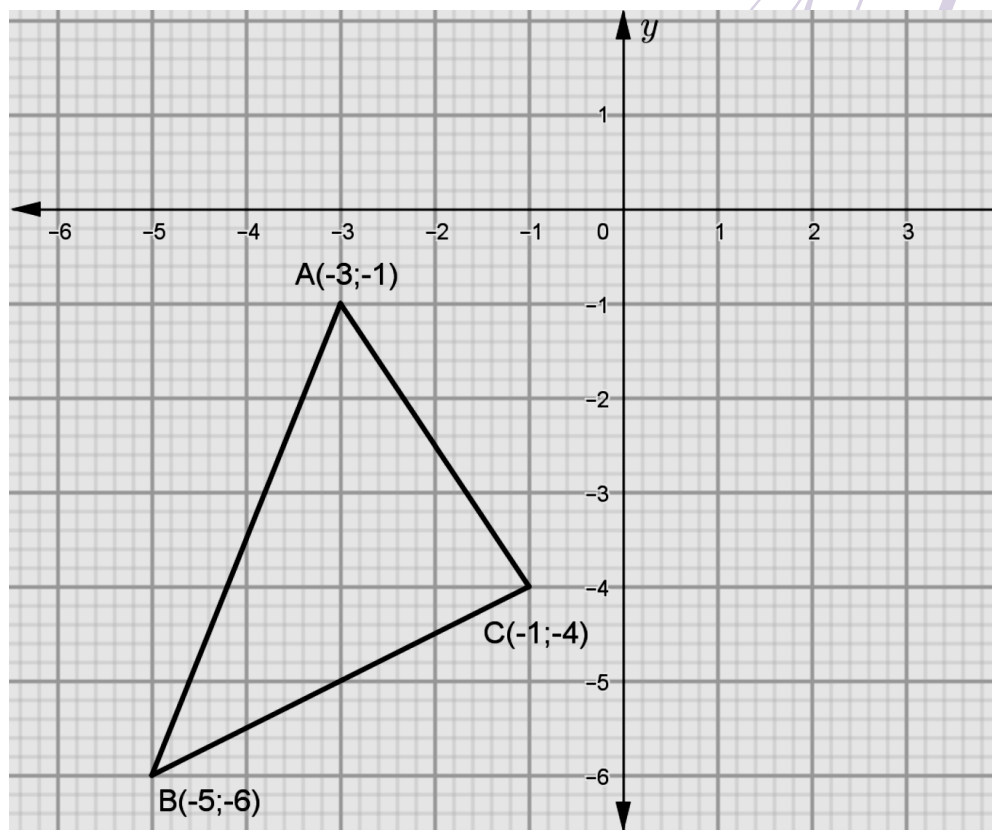
2.2.1   If ΔABC   is translated THREE units to the right and FOUR units
          upwards, write the coordinates of A$^{'}$, the image of A.   (2)

2.2.2   What would the coordinates of B become if it is reflected about the   (2)
          x-axes?

2.2.3   Determine the coordinates of C if it is reflected about the line $y = x$.   (2)

2.3 Given below is a rectangular prism with dimensions: $20cm \times 8cm \times 12cm$.
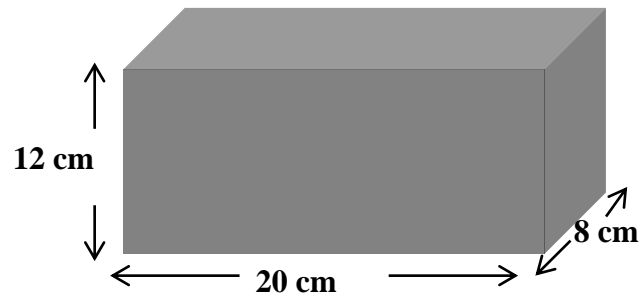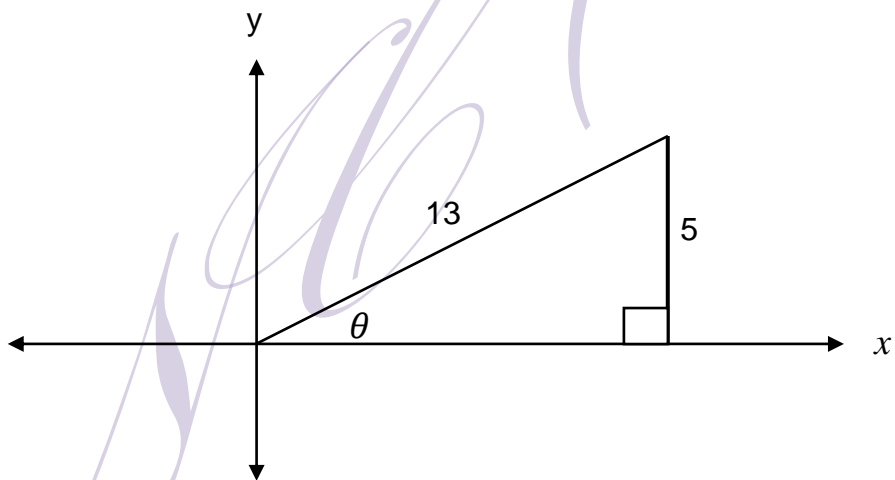

2.3.1 Calculate the surface area of the prism. (3)

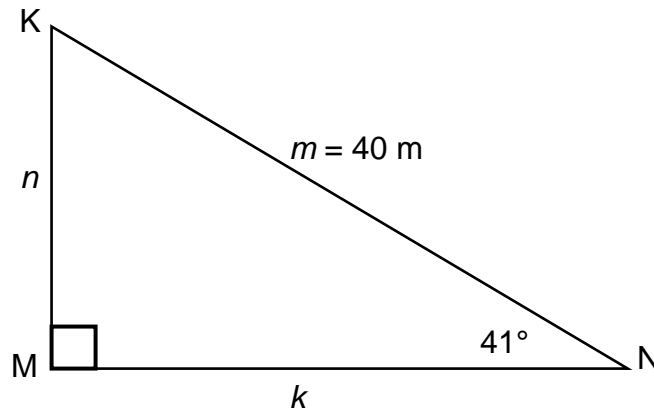2.3.2 Calculate the volume of the prism. (2)

[30]

QUESTION 3

3.1 Given $\sin\theta = \dfrac{5}{13}$ and $0° \le \theta \le 90°$. Study the diagram and answer the questions.

3.1.1 Determine the value of $\cos\theta$. (3)

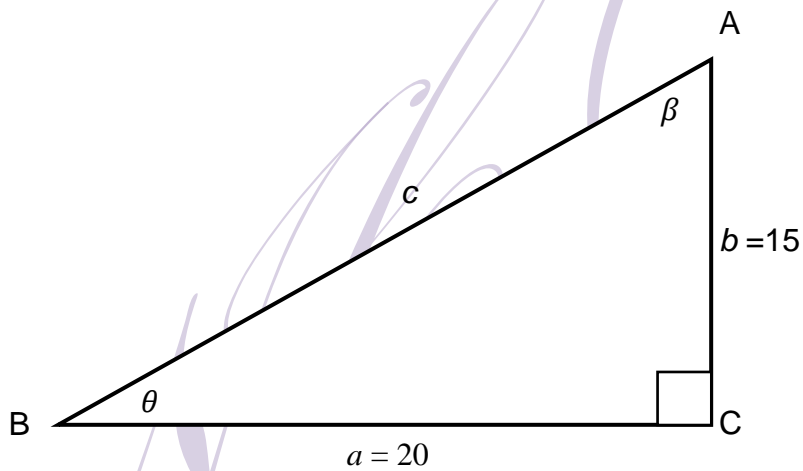3.1.2 Calculate the value of $\sin^2\theta + \cos^2\theta$. (3)

3.2   Given ΔKMN with M = 90°, N̂ = 41° and *m* = 40 m:

K

n

m = 40 m

41°

M k N

3.2.1   Determine the value of *n*.   (3)

3.2.2   Determine the value of *k*.   (3)

3.3   In $\triangle$ ABC : $\angle$ C = 90°, $\angle$ A = β, $\angle$ B = θ , a = 20 units and b = 15 units:

A

β

c

b = 15

θ

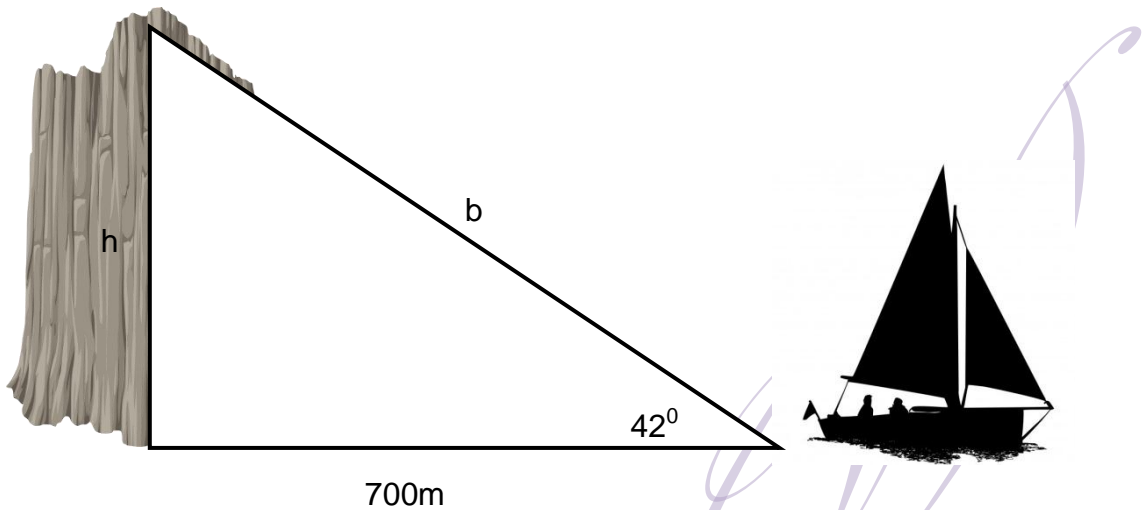B $a = 20$ C

3.3.1   Calculate the value of *c*.   (2)

3.3.2   Calculate the value of θ.   (2)

3.3.3   Determine the value of $\tan \theta \times \cos \beta$ in simplest form.   (3)

3.4   A boat is 700 m away from the foot of a vertical cliff. The angle of elevation from the boat to the top of the cliff is 42°.

3.4.1   Calculate the height of the cliff.   (3)

3.4.2   Calculate the value of b.   (3)

3.5   ON THE SAME SYSTEM of axis sketch the graph of $f(x) = \sin x - 1$ and $g(x) = -\cos x$ for $x \in [0°;360°]$ using the ADDENDUM B(attached).   (5)

[30]

TOTAL: 100

FORMULA SHEET

1. $A_{square} = l \times l = l^2$

2. $A_{rectangle} = l \times w$

3. $A_{triangle} = \dfrac{1}{2}b \times h$

4. $A_{circke} = \pi r^2$

5. $C = 2\pi r$

6. Area of a parallelogram = base × perpendicular height

7. $A_{hexagon} = \dfrac{3\sqrt{3}}{2}L^2$

8. $A_{hexagon} = \dfrac{\sqrt{3}}{2}W^2$

9. $A_{cylinder} = 2\pi r(h+r)$

10. Volume = area of base × perpendicular height

11. Total surface area of a triangular prism = (height of prism × perimeter of base) + 2(area of base)

12. $m = \dfrac{\Delta y}{\Delta x} = \dfrac{y_2 - y_1}{x_2 - x_1}$

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

14. $M = \left(\dfrac{x_1 + x_2}{2} ; \dfrac{y_1 + y_2}{2} \right)$

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

16. $\bar{x} = \dfrac{\sum\limits_{i=1}^{n} x_i}{n}$ or   Mean $= \dfrac{\text{total or sum of all items}}{\text{number of items}}$

17. $R = X_n - X_1$ **OR**   Range = highest value – lowest value

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

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

20. Interquartile range = upper quartile – lower quartile $=(Q_3 - Q_1)$

21. Semi-inter quartile range $= \dfrac{1}{2}$ (upper quartile – lower quartile) $= \dfrac{Q_3 - Q_1}{2}$

22. $P_{j \ position} = \dfrac{j}{100}(n+1)$
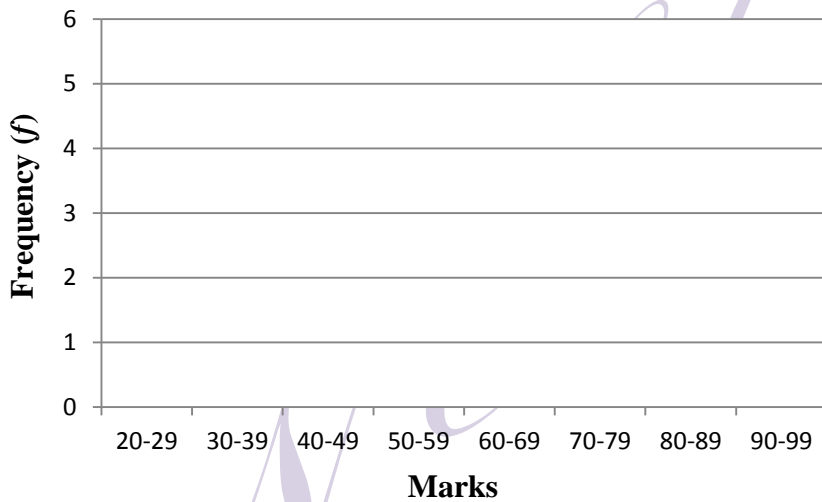
ADDENDUM A   **EXAMINATION NUMBER:**

1.4.1   Complete the following distribution table:

Marks intervals	Tally	Frequency
20–29		
30–39		
40–49		
50–59		
60–69		
70–79		
80–89		
90–99		
Total:		21

(8)

1.4.2   Draw a bar graph on the ADDENDUM using information from QUESTION 1.4.1.

(8)

ADDENDUM B   EXAMINATION NUMBER:

QUESTION 3.5

You may make use of the table below to help you draw the sketch

x	0°	90°	180°	270°	300°	360°
$y = \sin x - 1$						
$y = -\cos x$						

(5)