N5

NATIONAL

QUALIFICATIONS

Mark

N5/J

Mathematics

Combined Paper

45 minutes

Prelim Practice J

Fill in these boxes and read what is printed below

Forename(s)

Surname

Teacher

Total Marks - 40

Attempt ALL questions.

You must NOT use a calculator.

To earn full marks you must show your working in your answers.

State the units for your answer where appropriate.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

Before leaving the examination room you must give this book to the Invigilator; if you do not, you may lose all the marks for this paper.

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule: $\dfrac{a}{\sin \mathrm{A}} = \dfrac{b}{\sin \mathrm{B}} = \dfrac{c}{\sin \mathrm{C}}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: $A = \frac{1}{2}ab \sin C$

Volume of a sphere: $V = \dfrac{4}{3}\pi r^3$

Volume of a cone: $V = \dfrac{1}{3}\pi r^2 h$

Volume of a pyramid: $V = \dfrac{1}{3}Ah$

Standard deviation: $s = \sqrt{\dfrac{\sum (x - \bar{x})^2}{n - 1}}$

or $s = \sqrt{\dfrac{\sum x^2 - \dfrac{(\sum x)^2}{n}}{n - 1}}$, where n is the sample size.

MARKS

Section A – NON-CALCULATOR
Total marks — 15
Attempt ALL questions

1. Express $x^2 + 10x + 16$ in the form $(x + p)^2 + q$. **2**

2. Calculate $|\boldsymbol{a}|$, the magnitude of vector $\boldsymbol{a} = \begin{pmatrix} 6 \\ -2 \\ 3 \end{pmatrix}$. **2**

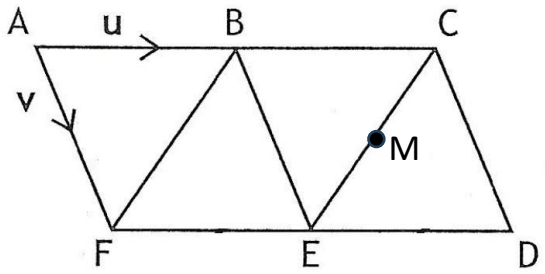
3. Where $x \neq 2$ and $x \neq -3$, express:

$$\frac{4}{x-2} - \frac{5}{x+3}$$

as a single fraction in its simplest form. **3**

4. The diagram shows a tiling of congruent triangles.

Vectors $\boldsymbol{u}$ and $\boldsymbol{v}$ are represented by $\overrightarrow{AB}$ and $\overrightarrow{AF}$ respectively.



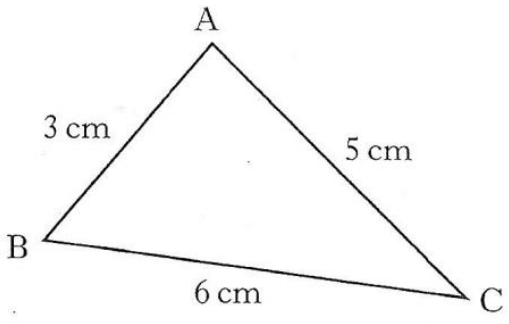
(a) Express $\overrightarrow{FB}$ in terms of $\boldsymbol{u}$ and $\boldsymbol{v}$. **1**

The point M is the midpoint of CE.

(b) Express $\overrightarrow{BM}$ in terms of $\boldsymbol{u}$ and $\boldsymbol{v}$. **2**

5. Determine the nature of the roots of $f(x) = 2x^2 + 4x - 3$ **3**

6. The diagram shows triangle ABC.



Find the value of $\cos B$.
Give your answer in its simplest form. **2**

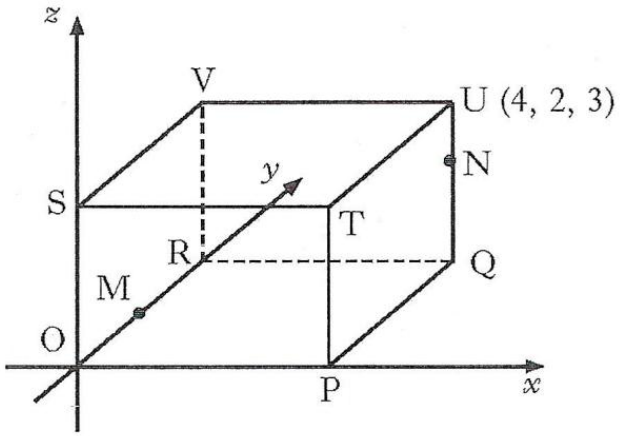
[END OF SECTION A]

Section B – CALCULATOR ALLOWED
Total marks — 15
Attempt ALL questions

7. Solve the equation $2x^2 - 3x - 7$.
Give your answer correct to **one decimal place**. **3**

8. The diagram below shows a cuboid relative to a set of coordinate axis.

U is the point $(4,2,3)$.



M is the midpoint of OR.

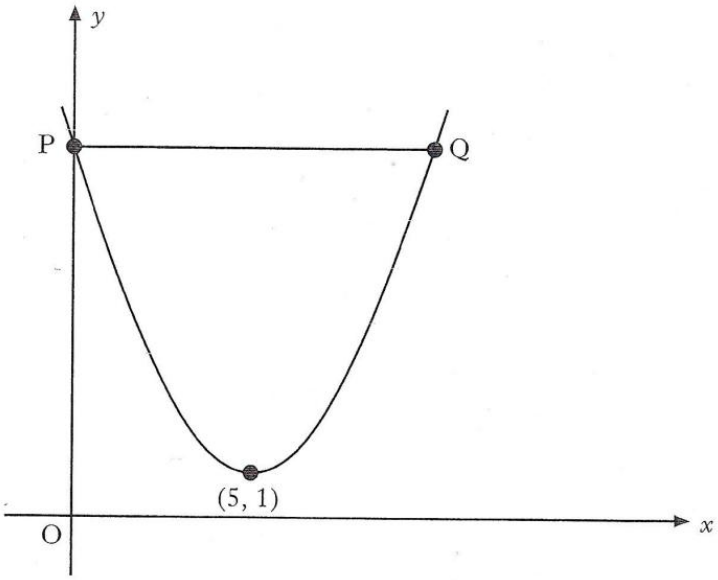
a) State the coordinates of point M. **1**

N is a point on UQ such that UN $= \frac{1}{3}$ UQ.

b) State the coordinates of point N. **1**

9. Solve the equation $5\cos x° + 7 = 3$ where $0 < x < 360$. **3**

10. The graph below shows part of a parabola with equation of the form $y = (x + a)^2 + b$.



(a) State the values of a and b. **2**

(b) The line PQ is parallel to the x-axis.
Find the coordinates of P and Q. **3**

11. Simplify: **2**

$$\frac{\sin^2 x}{1 - \sin^2 x}$$

[END OF SECTION B]

ANSWERS

1. $(x+5)^2-9$
2. 7
3. $\frac{-x+22}{(x-2)(x+3)}$
4. (a) $-\boldsymbol{v}+\boldsymbol{u}$ (b) $\frac{1}{2}\boldsymbol{v}+\frac{1}{2}\boldsymbol{u}$
5. $40>0$ so real, distinct roots
6. $\frac{5}{9}$
7. $x=2.8, x=-1.3$
8. (a) M $(0,1,0)$ (b) N $(4,2,2)$
9. $x=143.1, x=216.9$
10. (a) $a=-5$ and $b=1$ (b) P $(0,26)$ and Q $(10,26)$
11. $\tan^2 x$