# N5

# M$\alpha$thematics

## National 5 Practice Paper F

### Paper 1

Duration – 1 hour

Total marks – 40

- o  You may NOT use a calculator
- o  Attempt all the questions.
- o  Use **blue** or **black** ink.
- o  Full credit will only be given to solutions which contain appropriate working.
- o  State the units for your answer where appropriate.

**FORMULAE LIST**

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

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

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

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

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

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

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

Standard deviation: $\quad s = \sqrt{\dfrac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\sum x^2 - (\sum x)^2 / n}{n-1}}$ , where $n$ is the sample size.

1. Evaluate
$$1\frac{3}{5} + 2\frac{4}{7}.$$
2

2. (a) Factorise
$$4x^2 - y^2.$$
1

   (b) Hence simplify
$$\frac{4x^2 - y^2}{6x + 3y}.$$
2

3. A group of people attended a course to help them stop smoking.

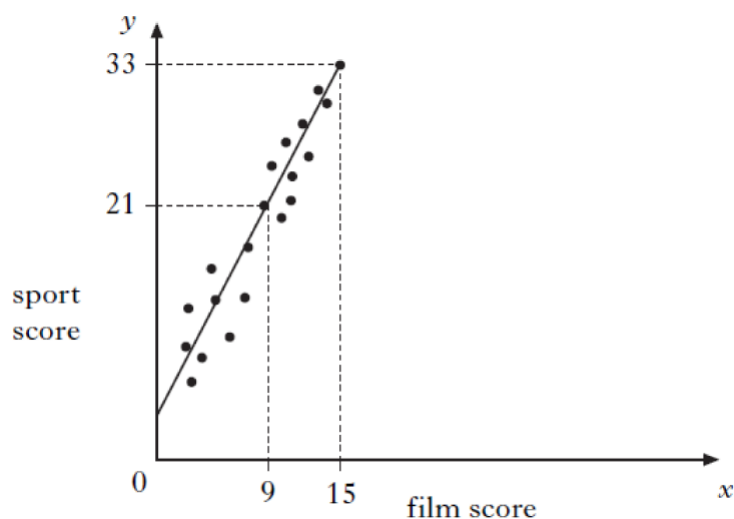   The following table shows the statistics before and after the course.

   |  | Mean number of cigarettes smoked per person per day | Standard deviation |
   |---|---|---|
   | Before | 20.8 | 8.5 |
   | After | 9.6 | 12.0 |

   Make **two** valid comments about these results.
2

4. Teams in a quiz answer questions on film and sport.

   This scatter graph shows the scores of some of the teams.



   A line of best fit is drawn as shown above.

   (a) Find the equation of this straight line.                               3

   (b) Use this equation to estimate the sport score for a team with
       a film score of 20.                                                    1

5. Given that $\overrightarrow{AB} = \begin{pmatrix} 3 \\ 0 \\ -3 \end{pmatrix}$ calculate $|\overrightarrow{AB}|$.

   Give your answer as a surd in its simplest form.                          3
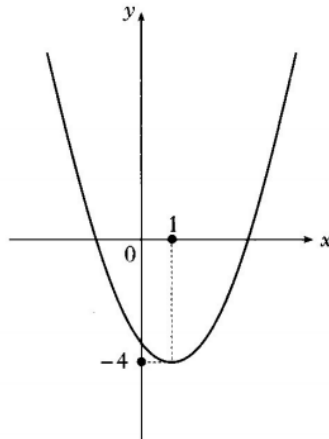
6. Solve the inequation

$$13 + 4x < 18 - 7(2 - x).$$  3

7. The graph of $y = x^2$ has been moved to the position shown in the diagram.



Write down the equation of the graph shown.  2

8. A straight line is represented by the equation $2y + x = 6$.
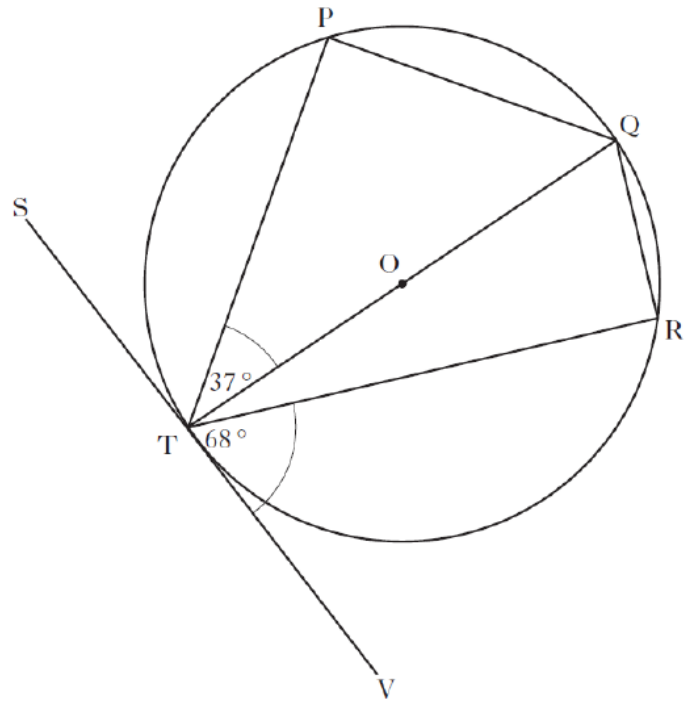
   (a)  Find the gradient of this line.  2

   (b)  This line crosses the $y$-axis at $(0, c)$. Find the value of $c$.  1

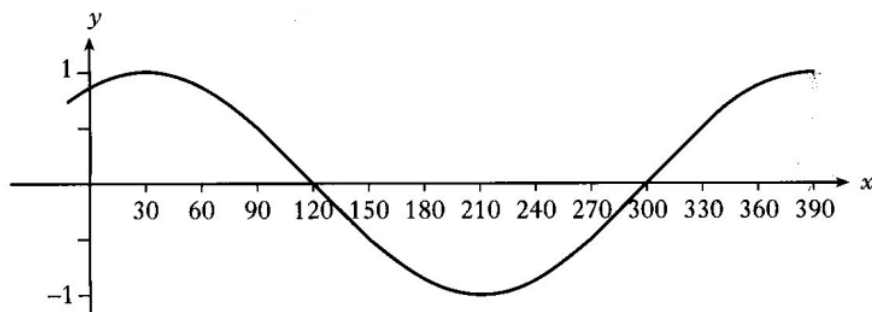9.    The tangent SV touches the circle, centre O, at T.

○  Angle PTQ is 37°.

○  Angle VTR is 68°.

Calculate the size of angle PQR.                    3

10.    The graph shown below has an equation of the form $y = \cos(x - a)°$.

Write down the value of $a$.                    1

11. Cleano washing powder is on special offer.



Each box on special offer contains 20% more powder than the standard box.

A box on special offer contains 900 grams of powder.

How many grams of powder does the standard box contain? 3

12. A parabola has equation $y = x^2 - 3x + 5$.

    (a)    Show that the parabola has no real roots. 2

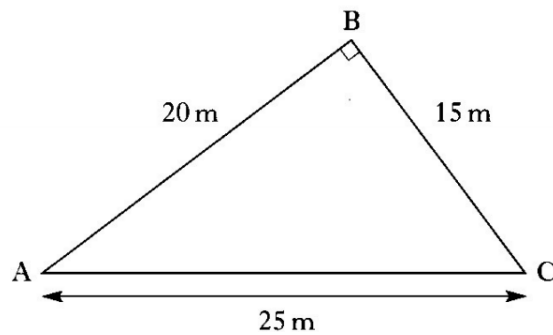    (b)    Write the equation in the form $y = (x - p)^2 + q$. 2

    (c)    Sketch the graph of $y = x^2 - 3x + 5$, showing the coordinates of the turning point and the point of intersection with the $y$-axis. 3

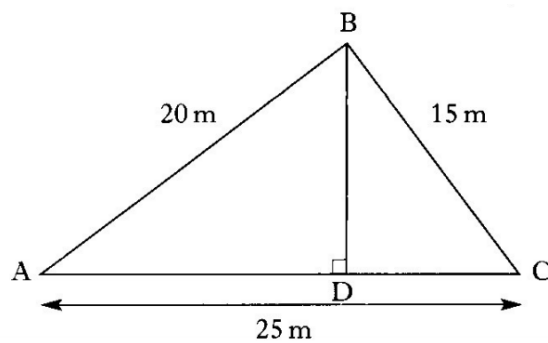13. Triangle ABC is right-angled at B.

The dimensions are shown.



(a) Calculate the area of triangle ABC.     1

BD, the height of triangle ACB is drawn as shown.



(b) Use your answer to part (a) to calculate the height BD.     3

**[End of question paper]**

# N5

# M$\alpha$thematics

## National 5 Practice Paper F

### Paper 2

Duration – 1 hour and 30 minutes

Total marks – 50

- o  You may use a calculator
- o  Attempt all the questions.
- o  Use **blue** or **black** ink.
- o  Full credit will only be given to solutions which contain appropriate working.
- o  State the units for your answer where appropriate.

**FORMULAE LIST**

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

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

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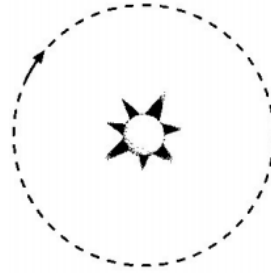
Volume of a pyramid: $V = \dfrac{1}{3} Ah$

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

1. The orbit of a planet around a star is circular.

   The radius of the orbit is $4.96 \times 10^7$ kilometres.

   Calculate the circumference of the orbit.

   Given your answer in scientific notation. 3

2. A boat was bought for £35 000. Its value decreases by 8% each year.

   How much will the boat be worth after 4 years? 3

3. Change the subject of the formula below to $x$.

   $$\frac{x}{c} + a = b$$

   2

4. Solve algebraically the system of equations

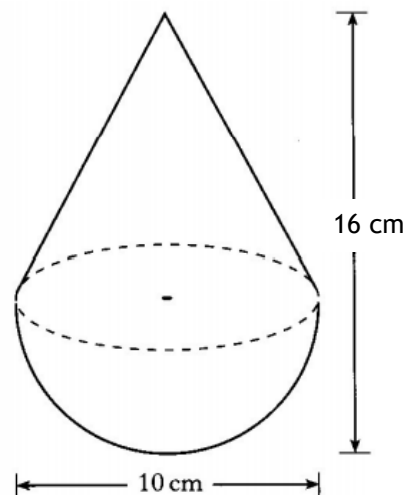   $$4x + 2y = 13$$
   $$5x + 3y = 17.$$

   3

5.  A child's toy is in the shape of a hemisphere with a cone on top, as shown in the diagram.

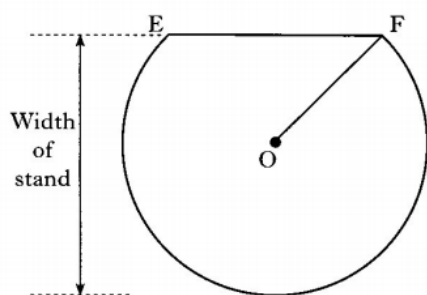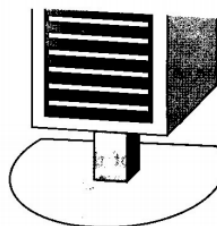    The toy is 10 centimetres wide and 16 centimetres high.

    Calculate the volume of the toy.

    Give your answer correct to two significant figures.

16 cm

10 cm

5

6.  The diagram shows the base of a loudspeaker stand which has the shape of part of a circle.
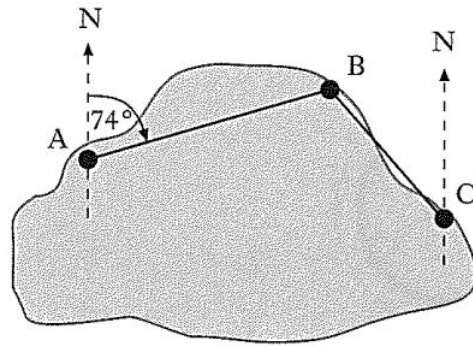
- The centre of the circle is O.
- EF is a chord of the circle.
- EF is 18 centimetres.
- The radius, OF, of the circle is 15 centimetres.

    Find the width of the stand.

4

7.   There are three mooring points on Lake Sorling.



- o   From A, the bearing of B is 074°.
- o   From C, the bearing of B is 310°.

(a)   Calculate the size of angle ABC.    2

B is 230 metres from A and 110 metres from C.

(b)   Calculate the direct distance from A to C.
      Give your answer to 3 significant figures.    4

8.   Express

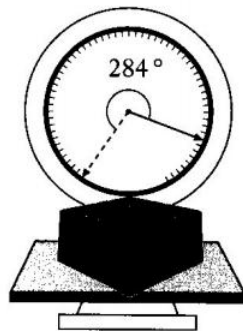$$\frac{3}{(x+1)} - \frac{1}{(x-2)} \quad , \qquad x \neq -1, \quad x \neq -2$$

as a single fraction in its simplest form.    3

9. A set of scales has a circular dial.

The pointer is 9 centimetres long.

The tip of the pointer moves through an arc of 2 centimetres for each 100 grams of weight on the scales.



A parcel, placed on the scales, moves the pointer through an angle of 284°.

Calculate the weight of the parcel.     4

10. The number of diagonals, $d$, in a polygon of $n$ sides is given by the formula

$$d = \frac{1}{2}n(n-3).$$

(a) How many diagonals does a polygon of 7 sides have?     2
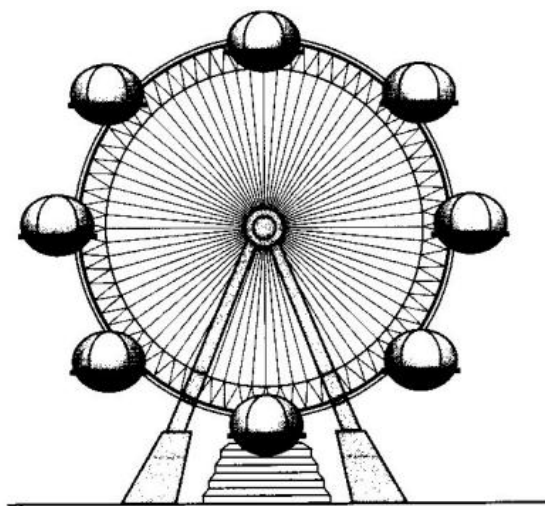
(b) A polygon has 65 diagonals.

Show that for this polygon, $n^2 - 3n - 130 = 0$.     2

(c) Hence find the number of sides in this polygon.     3

11.    Emma goes on the "Big Eye".



Her height, $h$ metres, above the ground is given by the formula

$$h = -31 \cos t° + 33$$

where $t$ is the number of seconds since the start.

(a)    Calculate Emma's height above the ground 20 seconds after the start.          2

(b)    When will Emma first reach a height of 60 metres above the ground?          3

(c)    When will she next be at a height of 60 metres above the ground?          1

12.    In triangle ABC,



- o   BC = 8 centimetres

- o   AC = 6 centimetres

- o   PQ is parallel to BC

- o   M is the midpoint of AC.

- o   Q lies on AC, $x$ centimetres from M, as shown in the diagram.
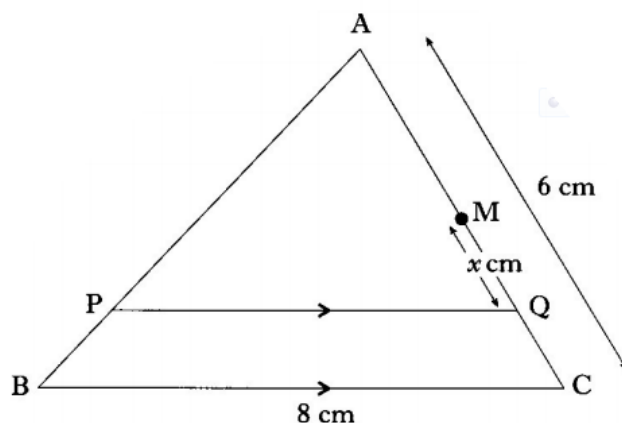
(a)    Write down an expression for the length of AQ.                            1

(b)    Show that $PQ = \left(4 + \dfrac{4}{3}x\right)$ centimetres.                    3

**[End of question paper]**