FOR OFFICIAL USE

N5

National Qualifications 2018

Mark

X847/75/01

Mathematics
Paper 1 (Non-Calculator)

FRIDAY, 4 MAY

9:00 AM – 10:15 AM

X8477501

Fill in these boxes and read what is printed below.

Full name of centre

WORKED SOLUTIONS

Town

Forename(s)

Surname

Number of seat

Date of birth

Day | Month | Year

Scottish candidate number

Total marks — 50

Attempt ALL questions.

You may 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 booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

SQA

X8477501

MARKS | DO NOT WRITE IN THIS MARGIN

Total marks — 50

Attempt ALL questions

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

$$\frac{7}{3}+\frac{4}{5}$$

$$\frac{35}{15}+\frac{12}{15}$$

$$\frac{47}{15}=3\frac{2}{15}$$

2. Expand and simplify $(3x+1)(x-1)+2(x^2-5)$. 3

$$3x^2-3x+x-1+2x^2-10$$

$$5x^2-2x-11$$

MARKS | DO NOT WRITE IN THIS MARGIN

3. Solve, algebraically, the system of equations

$$4x+5y=-3 \quad (\times 2)$$
$$6x-2y=5. \quad (\times 5)$$

3

$$8x + 10y = -6$$
$$\oplus \quad 30x - 10y = 25$$
$$38x = 19$$
$$x = \frac{19}{38}$$
$$x = \frac{1}{2}$$

$$4x + 5y = -3$$
$$4\left(\tfrac{1}{2}\right) + 5y = -3$$
$$2 + 5y = -3$$
$$5y = -5$$
$$y = -1$$

4. Two vectors are given by $\mathbf{u}=\begin{pmatrix}1\\5\\1\end{pmatrix}$ and $\mathbf{u}+\mathbf{v}=\begin{pmatrix}6\\-4\\3\end{pmatrix}$.

Find vector $\mathbf{v}$.

Express your answer in component form.

2

$$\mathbf{v} = \begin{pmatrix}6\\-4\\3\end{pmatrix} - \begin{pmatrix}1\\5\\1\end{pmatrix} = \begin{pmatrix}5\\-9\\2\end{pmatrix}$$

MARKS | DO NOT WRITE IN THIS MARGIN

5. Solve

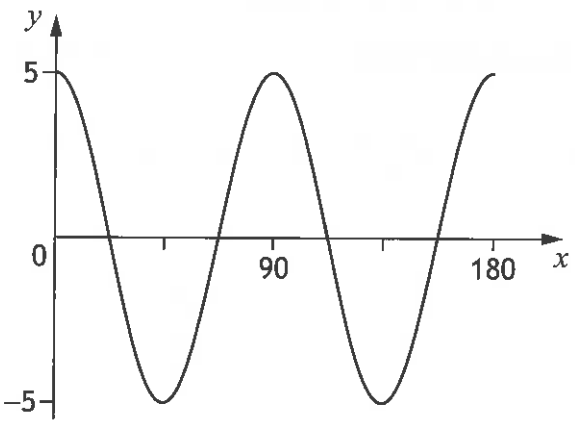
$$x^2 - 11x + 24 = 0.$$ 2

$(x-3)(x-8) = 0$

$x - 3 = 0$ or $x - 8 = 0$

$x = 3$ or $x = 8$

6. Part of the graph of $y = a\cos bx°$ is shown in the diagram.



State the values of a and b. 2

a = Amplitude = 5 Period = 90°

$b = 4$

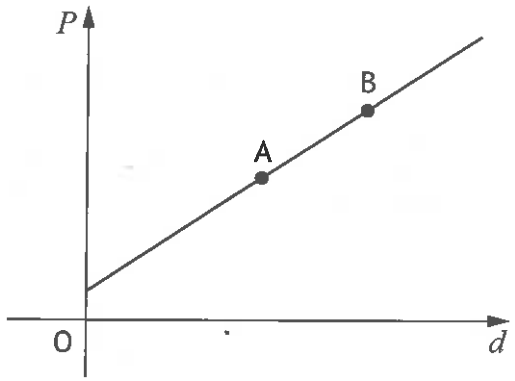
$y = 5\cos 4x°$

$a = 5$ and $b = 4$

MARKS | DO NOT WRITE IN THIS MARGIN

7. The cost of a journey with Tom's Taxis depends on the distance travelled.

The graph below shows the cost, P pounds, of a journey with Tom's Taxis against the distance travelled, d miles.



Point A represents a journey of 8 miles which costs £14.

Point B represents a journey of 12 miles which costs £20.

(a) Find the equation of the line in terms of P and d.

Give the equation in its simplest form. 3

A(8, 14) B(12, 20)

$$m = \frac{20-14}{12-8} = \frac{6}{4} = \frac{3}{2}$$

$$y - b = m(x - a)$$
$$y - 14 = \frac{3}{2}(x - 8)$$
$$y - 14 = \frac{3}{2}x - 12$$
$$y = \frac{3}{2}x + 2$$
$$P = \frac{3}{2}d + 2$$

7. (continued)

(b) Calculate the cost of a journey of 5 miles. 1

$d = 5$

$P = \frac{3}{2}(5) + 2$

$= 7.5 + 2$

$= 9.5$

Cost = £9.50

8. Determine the nature of the roots of the function $f(x) = 2x^2 + 4x + 5$. 2

Let $2x^2 + 4x + 5 = 0$ for roots.

$a = 2$
$b = 4$
$c = 5$

Discriminant $= b^2 - 4ac$

$= 4^2 - 4(2)(5)$

$= 16 - 40$

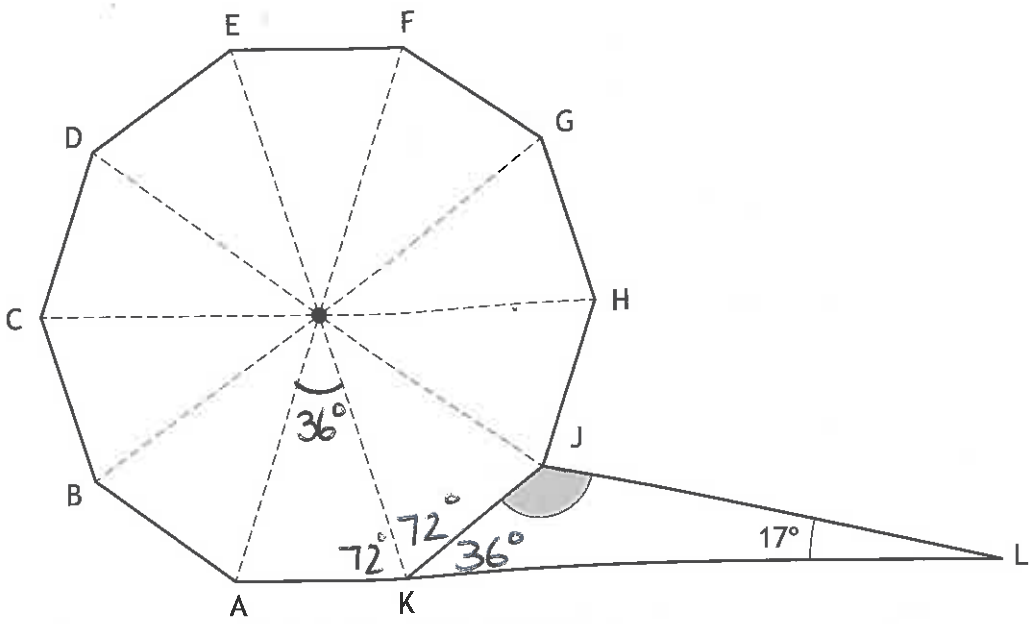
$= -24$

Since $b^2 - 4ac < 0$, there are no real roots for function $f(x)$.

MARKS | DO NOT WRITE IN THIS MARGIN

9. In the diagram shown below, ABCDEFGHJK is a regular decagon.

- Angle KLJ is 17°.
- AKL is a straight line.



Calculate the size of shaded angle KJL. 2

$360^\circ \div 10 = 36^\circ$

$180 - 36 = 144^\circ$

$144 \div 2 = 72^\circ$

$180 - (72+72) = 36^\circ$

$180 - (36+17)$

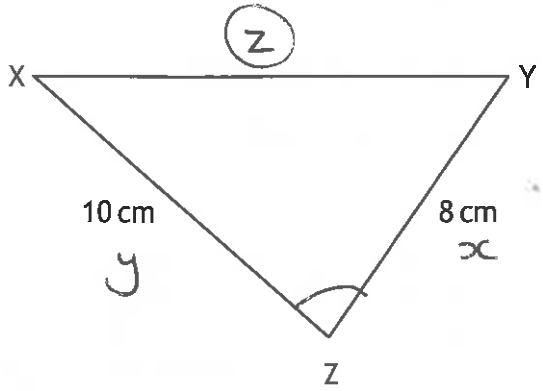
$180 - 53 = 127^\circ$

Shaded angle $= 127^\circ$

MARKS | DO NOT WRITE IN THIS MARGIN

10. In triangle XYZ:

- XZ = 10 centimetres
- YZ = 8 centimetres
- $\cos Z = \frac{1}{8}$.



Calculate the length of XY. 3

$z^2 = 8^2 + 10^2 - 2(8)(10)\left(\frac{1}{8}\right)$

$= 64 + 100 - 20$

$z^2 = 144$

$z = \sqrt{144}$

$z = 12$

Length XY = 12cm.

MARKS | DO NOT WRITE IN THIS MARGIN

11. Express $\frac{9}{\sqrt{6}}$ with a rational denominator.

Give your answer in its simplest form. 2

$$\frac{9}{\sqrt{6}} = \frac{9\sqrt{6}}{6} = \frac{3\sqrt{6}}{2}$$

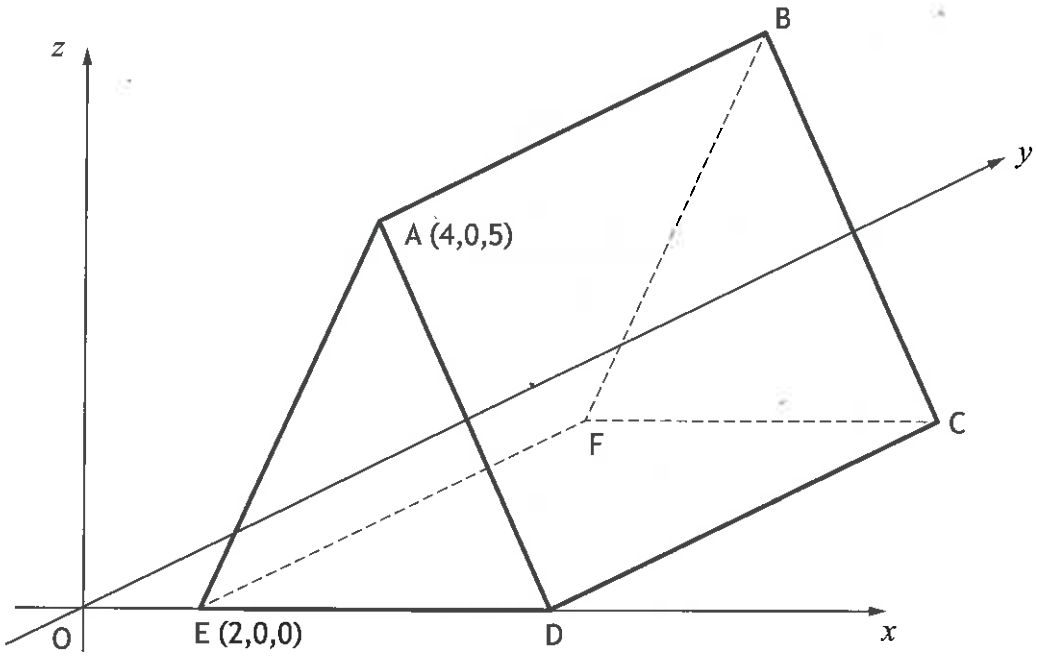
12. Given that $\cos 60° = 0{\cdot}5$, state the value of $\cos 240°$. 1

$$\cos 240° = -\cos 60°$$

$$\cos 240° = -0.5$$

MARKS | DO NOT WRITE IN THIS MARGIN

13. The diagram shows a triangular prism, ABCDEF, relative to the coordinate axes.



- AD = AE.
- DC = 8 units.
- Edges EF, DC and AB are parallel to the y-axis.

Write down the coordinates of B and C. **2**

B(4, 8, 5) and C(6, 8, 0)

MARKS | DO NOT WRITE IN THIS MARGIN

14. Change the subject of the formula $y = g\sqrt{x} + h$ to x. 3

$$g\sqrt{x} + h = y$$
$$g\sqrt{x} = y - h$$
$$\sqrt{x} = \frac{y-h}{g}$$
$$x = \left(\frac{y-h}{g}\right)^2$$

15. Remove the brackets and simplify $\left(\frac{2}{3}p^4\right)^2$. 2

$$\left(\frac{2}{3}p^4\right)^2 = \frac{4}{9}p^8$$

MARKS | DO NOT WRITE IN THIS MARGIN

16. Sketch the graph of $y=(x-6)(x+4)$.

On your sketch, show clearly the points of intersection with the x-axis and the y-axis, and the coordinates of the turning point. **3**

Roots: $(x-6)(x+4)=0$

$x-6=0$ or $x+4=0$

$x=6$ $\qquad$ $x=-4$.

Roots are $(-4,0)$ and $(6,0)$

Axis of symmetry occurs at $x=1$

Turning Point $\quad y=(1-6)(1+4)$

$y=(-5)(5)=-25$

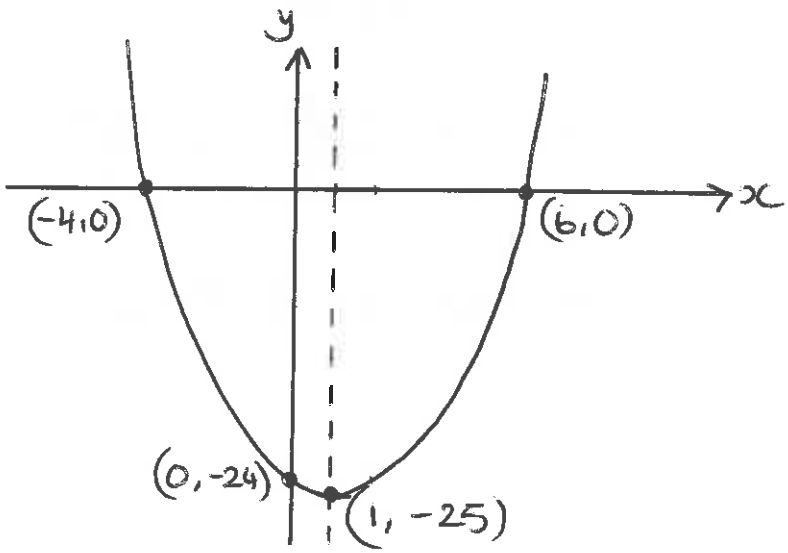
Minimum TP $(1,-25)$

Y-intercept @ $x=0$

$y=(0-6)(0+4)=-24$

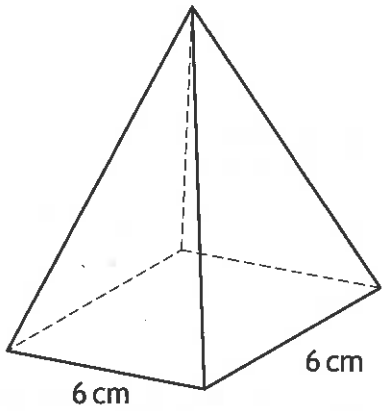
Y-intercept $(0,-24)$

Sketch



MARKS | DO NOT WRITE IN THIS MARGIN

17. A square based pyramid is shown in the diagram below.



The square base has length 6 centimetres.

The volume is 138 cubic centimetres.

Calculate the height of the pyramid. 3

$V_{pyramid} = \frac{1}{3} A_{base} \cdot H$

$A_{base} = 6 \times 6 = 36\ cm^2$

↳ $V = \frac{1}{3} A \cdot H$

$138 = \frac{1}{3}(36) \times H$

$138 = 12H$

$H = \frac{138}{12} = \frac{69}{6} = 11\frac{3}{6}$

Height = 11.5 cm

MARKS | DO NOT WRITE IN THIS MARGIN

18. Express $\sin x° \cos x° \tan x°$ in its simplest form.
Show your working. 2

$\sin x° \cos x° \tan x°$

but $\tan x = \frac{\sin x}{\cos x}$

$\sin x° \cos x° \frac{\sin x°}{\cos x°}$

$\rightarrow \sin^2 x$

MARKS | DO NOT WRITE IN THIS MARGIN

19. (a) (i) Express $x^2-6x-81$ in the form $(x-p)^2+q$. 2

$[x^2-6x]-81$

$(x-3)^2-3^2-81$

$(x-3)^2-9-81$

$(x-3)^2-90$

(ii) Hence state the equation of the axis of symmetry of the graph of $y=x^2-6x-81$. 1

Axis of symmetry

$x=3$

MARKS | DO NOT WRITE IN THIS MARGIN

19. (continued)

(b) The roots of the equation $x^2 - 6x - 81 = 0$ can be expressed in the form $x = d \pm d\sqrt{e}$.

Find, algebraically, the values of d and e. 4

$a = 1$

$b = -6$

$c = -81$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

but $b^2 - 4ac = (-6)^2 - 4(1)(-81)$

$= 36 + 324$

$= 360$

$$x = \frac{6 \pm \sqrt{360}}{2}$$

$\sqrt{360}$

$\sqrt{36}\sqrt{10}$

$6\sqrt{10}$

$$x = \frac{6 \pm 6\sqrt{10}}{2}$$

$$x = 3 \pm 3\sqrt{10}$$

$d = 3$ and $e = 10$

[END OF QUESTION PAPER]