FOR OFFICIAL USE

N5

National Qualifications 2022

Mark

X847/75/01

Mathematics
Paper 1 (Non-calculator)

WEDNESDAY, 4 MAY
9:00 AM – 10:00 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 — 40

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

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A/PB

FORMULAE LIST

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

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

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 $V = \frac{4}{3}\pi r^3$

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

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

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

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

MARKS | DO NOT WRITE IN THIS MARGIN

Total marks — 40

Attempt ALL questions

1. Evaluate

$$\frac{2}{3}\left(\frac{1}{5}+\frac{3}{4}\right).$$

Give your answer in its simplest form. **2**

$$\frac{2}{3} \times \left(\frac{1}{5} + \frac{3}{4}\right)$$

$$\frac{2}{3} \times \left(\frac{4}{20} + \frac{15}{20}\right)$$

$$\frac{2}{3} \times \frac{19}{20}$$

$$= \frac{19}{30}$$

2. Given that $f(x) = x^3 - 2$, evaluate $f(-3)$. **2**

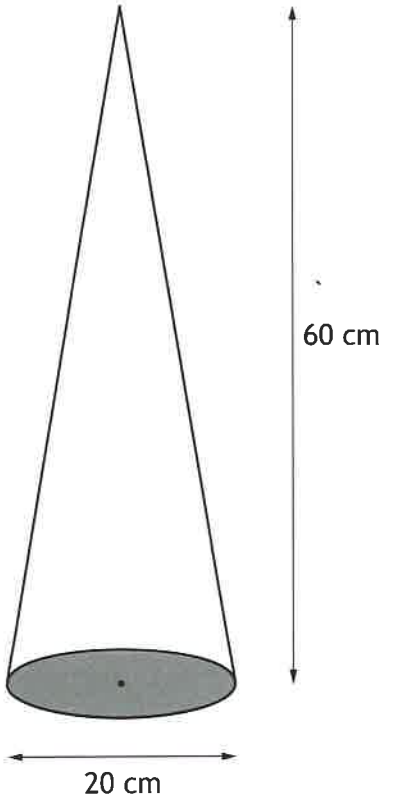
$$f(-3) = (-3)^3 - 2$$

$$= -27 - 2$$

$$f(-3) = -29$$

MARKS | DO NOT WRITE IN THIS MARGIN

3. The diagram below shows a cone with diameter 20 centimetres and height 60 centimetres.



$D = 20cm$

$r = 10cm$

Calculate the volume of the cone. 2

Take $\pi = 3.14$.

$$V_{cone} = \frac{1}{3}\pi r^2 h$$

$$= \frac{1}{3} \times \pi \times 10^2 \times 60$$

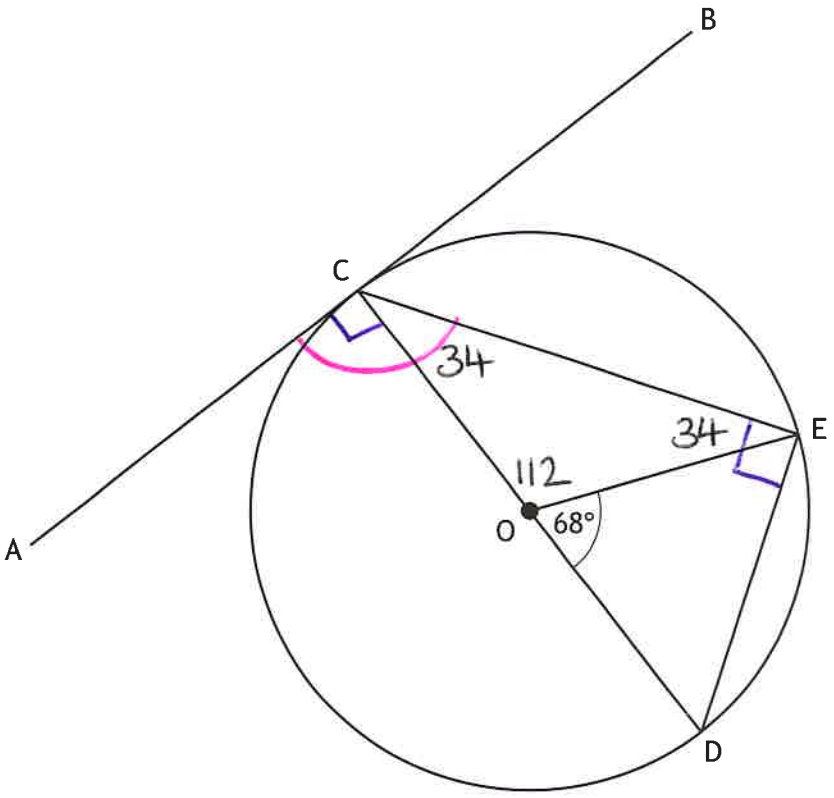
$$= \frac{1}{3} \times \pi \times 100 \times 60$$

$$= 3.14 \times 100 \times 20$$

$$= 314 \times 20$$

$$V_{cone} = 6280\ cm^3$$

4. The diagram below shows a circle with centre O.



AB is a tangent to the circle at the point C.

CD is a diameter of the circle.

Angle EOD is 68°.

Calculate the size of angle ACE. **3**

180 − 68 = 112

$\frac{1}{2}$ of 68 = 34

Angle ACE = 90 + 34

= 124°

Angle ACE =

MARKS | DO NOT WRITE IN THIS MARGIN

5. (a) Express $x^2+8x+15$ in the form $(x+a)^2+b$. **2**

$(x+4)^2-16+15$

$(x+4)^2-1$

(b) Hence, or otherwise, state the coordinates of the turning point of the graph of $f(x)=x^2+8x+15$. **1**

Min TP $(-4,-1)$

6. Find the equation of the line passing through the points (–3,–1) and (–5,7). **3**
Give the equation in its simplest form. $x_1\ y_1 \quad x_2\ y_2$

Gradient:

$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{7-(-1)}{-5-(-3)}=\frac{8}{-2}=-4$$

Equation:

$m=-4$
$a=-5$
$b=7$

$y-b=m(x-a)$
$y-7=-4(x-(-5))$
$y-7=-4x-20$
$y=-4x-13.$

MARKS | DO NOT WRITE IN THIS MARGIN

7. Change the subject of the formula $D = \frac{B+4}{C^2}$ to B. **2**

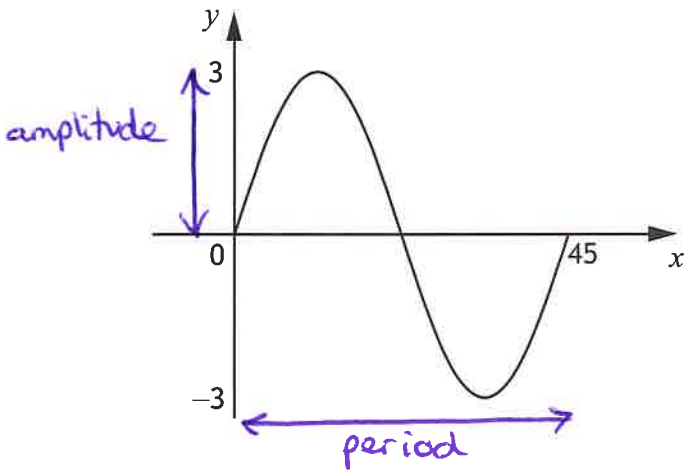
$C^2D = B + 4$

$C^2D - 4 = B$

↳ $B = C^2D - 4$

$B = DC^2 - 4$
also acceptable.

8. Part of the graph of $y = a\sin bx^\circ$ is shown in the diagram.



(a) State the value of a. **1**

$a = 3$

amplitude = 3.

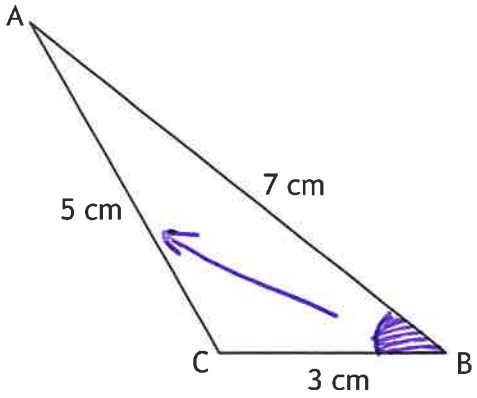
(b) State the value of b. **1**

$b = 8$

period = 45°
so 8 waves
between 0° and 360°

MARKS | DO NOT WRITE IN THIS MARGIN

9. The diagram shows triangle ABC.



- AB = 7 centimetres
- BC = 3 centimetres
- AC = 5 centimetres

Calculate the value of cos B.

Give your answer in its simplest form. **2**

$$\cos B = \frac{3^2 + 7^2 - 5^2}{2 \times 3 \times 7}$$

$$= \frac{9 + 49 - 25}{42}$$

$$= \frac{33}{42}$$

$$\cos B = \frac{11}{14}$$

MARKS | DO NOT WRITE IN THIS MARGIN

10. Tommy buys flower seeds from a website.

Tommy is given a 30% discount. He pays £16.10 for the seeds.

Calculate the cost of the flower seeds without the discount. **3**

$100\% - 30\% = 70\%$

$70\% = £16.10$

$10\% = £2.30$

$100\% = £23.$

$$7 \overline{)16.10}$$ 2.30

The seeds originally cost £23.

11. Simplify $\left(m^{-2}\right)^4 \times m^{-5}$.

Give your answer with a **positive** power. **3**

$(m^{-2})^4 \times m^{-5}$

$m^{-8} \times m^{-5}$

$= m^{-13}$

$= \frac{1}{m^{13}}$

MARKS | DO NOT WRITE IN THIS MARGIN

2. Express $\frac{4}{x+2} \div \frac{5}{(x+2)^2}$, $x \neq -2$ as a single fraction in its simplest form. **2**

$$= \frac{4}{(x+2)} \times \frac{(x+2)^2}{5}$$

$$= \frac{4(x+2)^2}{5(x+2)}$$

$$= \frac{4(x+2)}{5}$$

$$= \frac{4x+8}{5}$$

13. Expand and simplify $\sqrt{10}\left(\sqrt{10}-\sqrt{2}\right)+8\sqrt{5}$. **3**

$$\sqrt{10}(\sqrt{10}-\sqrt{2}) + 8\sqrt{5}$$

$$\sqrt{100} - \sqrt{20} + 8\sqrt{5}$$

$$10 - \sqrt{4}\sqrt{5} + 8\sqrt{5}$$

$$10 - 2\sqrt{5} + 8\sqrt{5}$$

$$= 10 + 6\sqrt{5}$$

MARKS | DO NOT WRITE IN THIS MARGIN

14. Sketch the graph of $y = (x+1)(x-3)$ using the axes provided below.

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**

(Additional axes, if required, can be found on *page 14*.)

y-intercept at $x=0$

$y = (0+1)(0-3)$

$y = (1)(-3)$

$y = -3$

Point $(0,-3)$

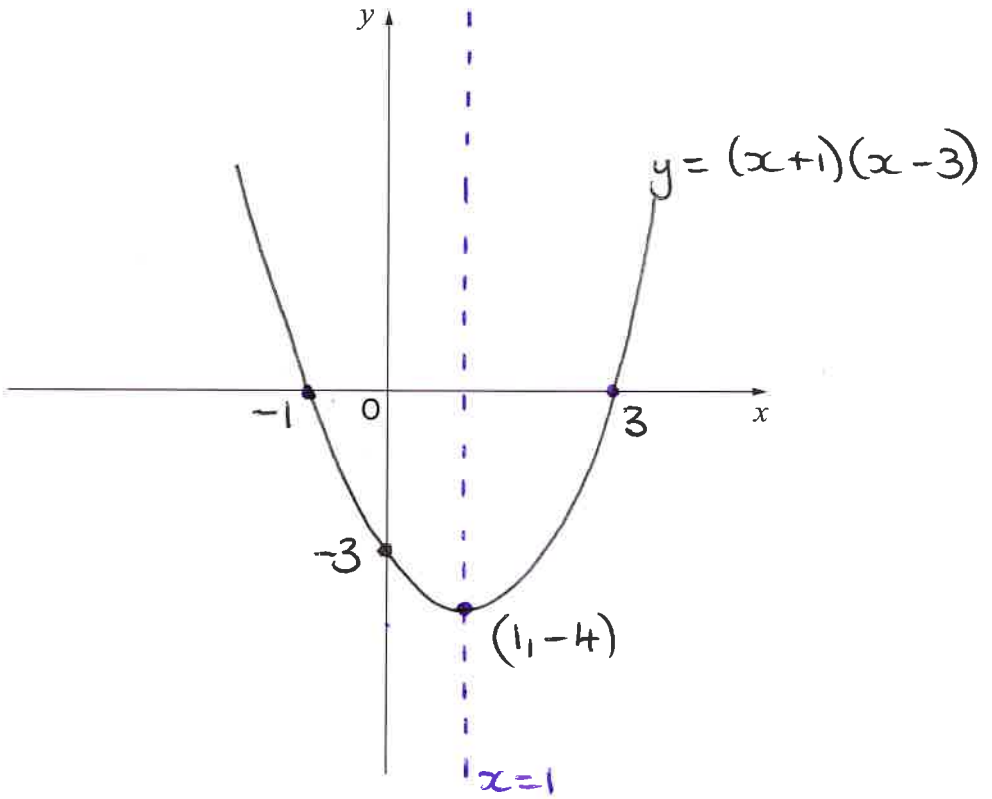
Roots occur at $y=0$

$(x+1)(x-3) = 0$

$\therefore x = -1, \; x = 3$

Roots $(-1,0)$ and $(3,0)$

Sketch:



Axis of symmetry

$x = \frac{-1+3}{2} = 1$

Turning Point at $x=1$

$y = (1+1)(1-3)$

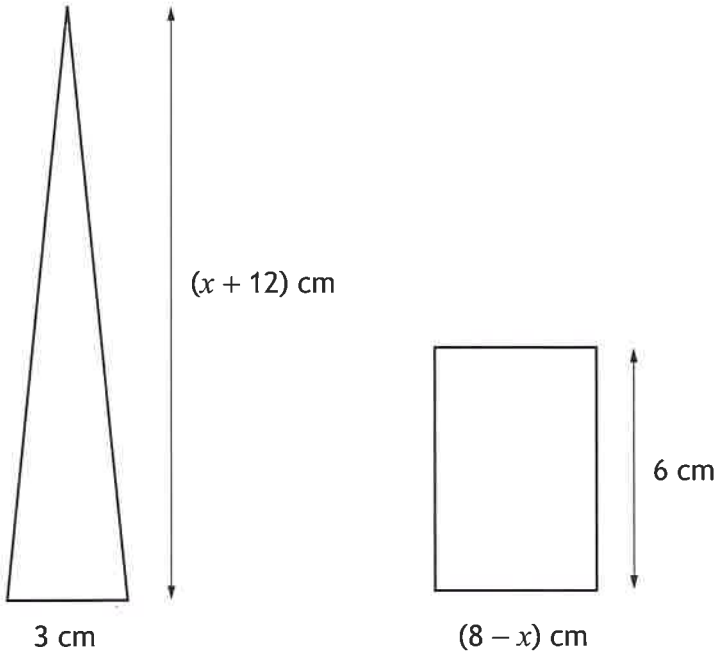
$y = (2)(-2)$

$y = -4$

Min TP $(1,-4)$

MARKS | DO NOT WRITE IN THIS MARGIN

15. A triangle and rectangle are shown in the diagram.



(a) Find an expression for the area of the triangle. 1

Area $\Delta = \frac{1}{2}bh$

$= \frac{1}{2}(3)(x+12)$

$= \frac{3}{2}(x+12)$

Area $= \frac{3}{2}x + 18$

MARKS | DO NOT WRITE IN THIS MARGIN

15. (continued)

(b) Given that the area of the triangle is equal to the area of the rectangle, find algebraically the value of x. **4**

Area Rect $= 6(8-x)$

For equal areas

let $\frac{3}{2}(x+12) = 6(8-x)$

$3(x+12) = 12(8-x)$

$(x+12) = 4(8-x)$

$x+12 = 32-4x$

$5x = 20$

$x = 4$.

[END OF QUESTION PAPER]

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS

Additional axes for question 14.