

AMERICAN ACADEMY LARNACA

MATHEMATICS PLACEMENT EXAM

YEAR 4

SAMPLE 3

DURATION: 2 hours 15 minutes

NAME:

Instructions to candidates

Full marks may be obtained for answers to **ALL** questions.

Answer **ALL** questions in the spaces provided in this paper.

Show all stages in any calculations.

Calculators can be used.

This paper has **30** questions.

Question 1

Find the value, without using a calculator:

$$(5 - 3^2)^3 + \sqrt{6^2 - 4 \times 5 + 81 \div 9}$$

.....
(3)

Question 2

Simplify the following expressions fully.

(a) $5x^3y^{-7} \times 4x^{-5}y^{-2}$

(b) $\frac{4a^7b^{-5}}{30a^{-3}b^8}$

(c) $\left(2p^{-3}q^2r^{\frac{2}{5}}\right)^5$

Question 3

(6)

Write as a single fraction in its simplest form

(a) $\frac{3}{x-2} - \frac{4}{x+1}$

.....
(2)

(b) $\frac{2}{x-3} + \frac{13}{x^2+4x-21}$

.....
(3)

Question 4

Simplify these expressions

(a) $\frac{3x^2}{(2x^2+7x+6)} \times \frac{7(3+2x)}{3x^5}$

.....
(3)

(b) $\frac{x^2-8x+15}{x^2-9} \div \frac{(x-5)^2}{2x^2+6x}$

.....
(3)

Question 5

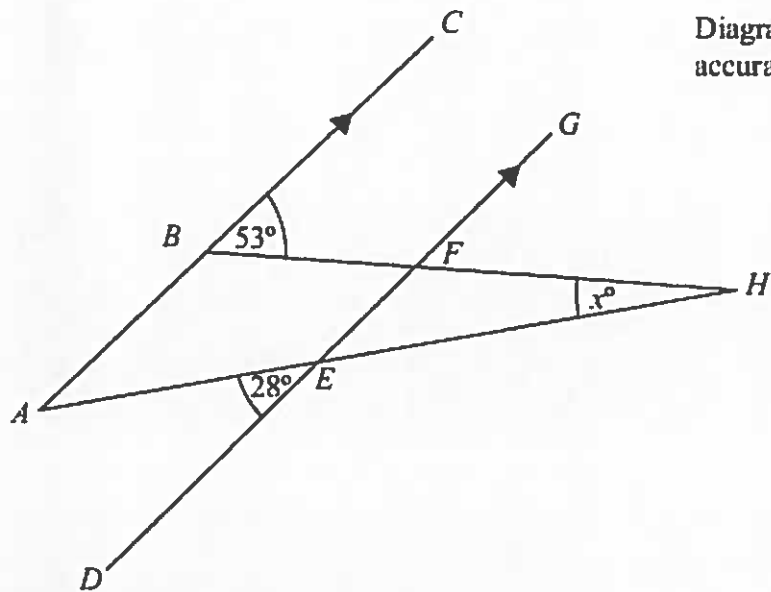


Diagram NOT accurately drawn

ABC and *DEFG* are parallel.
AEH and *BFH* are straight lines.
 Work out the size of the angle marked x° .

.....^o
 (3)

Question 6

Solve the simultaneous equations

$$3x + 7y = 26$$

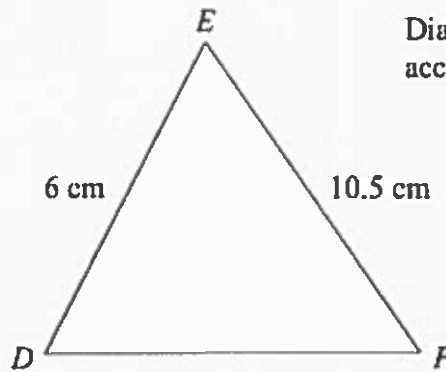
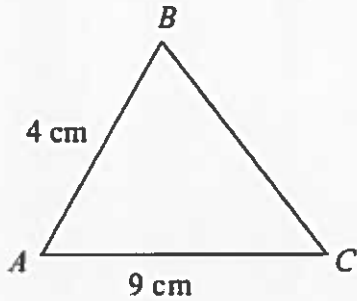
$$4x + 5y = 13$$

$x = \dots\dots\dots$

$y = \dots\dots\dots$

(3)

Question 7



Diagrams NOT accurately drawn

Triangles ABC and DEF are similar.

$$AB = 4\text{ cm.}$$

$$AC = 9\text{ cm.}$$

$$DE = 6\text{ cm.}$$

$$EF = 10.5\text{ cm.}$$

Work out the length of DF .

.....

(3)

Question 8

Work out an estimate for the value of

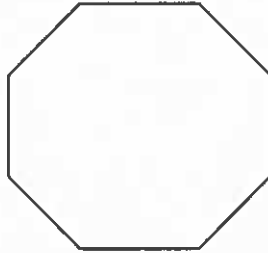
$$\frac{5.97 \times 312}{0.523}$$

.....

(2)

Question 9

The diagram shows a regular octagon.



(a) Calculate the size of the interior angle of a regular octagon.

.....
(2)

(b) Calculate the size of the exterior angle of a regular octagon.

.....
(2)

Question 10
Solve the equation

$$4^{2x-1} = 32^{3x}$$

$x = \dots\dots\dots$
(3)

Question 11

Simon wants to find out how much people spend using their mobile phone.

He uses this question on a questionnaire.

How much do you spend using your mobile phone?		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
£1-£5	£5-£10	£10-£15

(a) Write down two things that are wrong with this question.

- 1
-
- 2
-

(2)

(b) Design a better question for his questionnaire to find out how much people spend using their mobile phone. You should include some response boxes.

(2)

Question 12

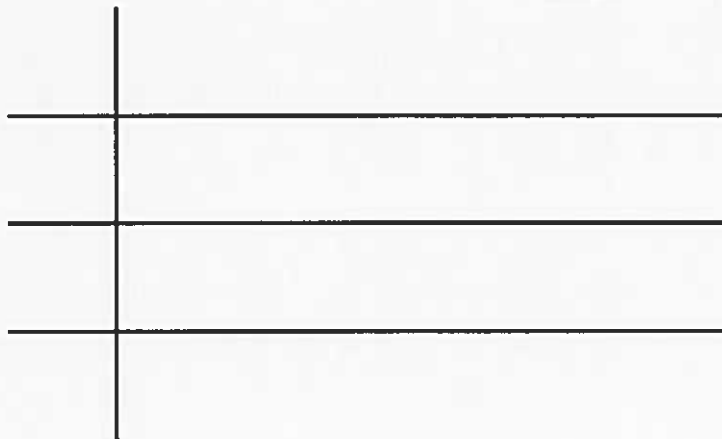
Stephen plays in a basketball team.

The list shows the numbers of points Stephen scored in 15 games of basketball this year.

26 14 33 8 21 18 20 9 17 22 21 18 22 30 25

(a) Show this information in an ordered stem and leaf diagram.

Key:



(b) Work out the interquartile range.

(2)

.....
(3)

Question 13

Prove that the recurring decimal $0.12\dot{8}$ can be expressed as the fraction $\frac{29}{225}$.

(3)

Question 14

Make x the subject of the formula

(a) $\frac{b\sqrt{w-x}}{d} + a = k$

.....
(3)

(b) $\frac{2-3x}{x+2} = k$

.....
(3)

Question 15

The functions $f(x)$ and $g(x)$ are defined as

$$f(x) = 3x - 1 \quad \text{and} \quad g(x) = 2x^2 + 1$$

(a) Find the value

(i) $f(4)$

.....
(1)

(ii) $g(-3)$

.....
(1)

(iii) $gf(0)$

.....
(2)

(b) Find $fg(x)$

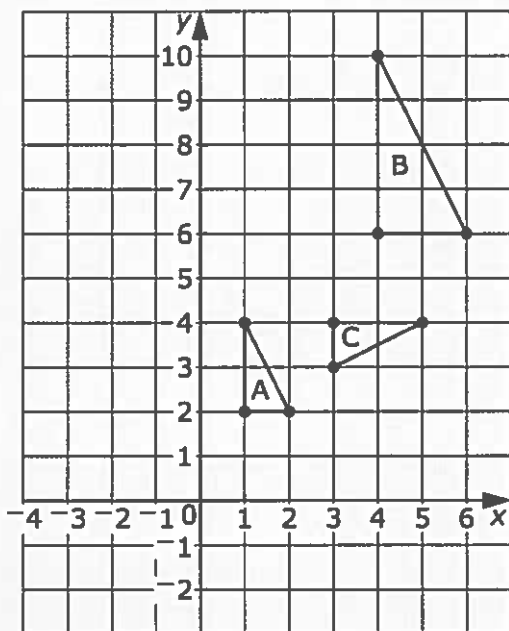
.....
(2)

(c) Find the inverse function of $f(x)$.

.....
(2)

Question 16

The diagram shows three triangles A, B and C on a grid.



- (a) Translate A by the vector $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$. Label it D. (2)

- (b) Describe fully the single transformation that takes A onto B.

.....

(2)

- (c) Describe fully the single transformation that takes A onto C.

.....

(2)

Question 17

There are only red counters, blue counters, green counters and yellow counters in a bag.

The table shows the probabilities of picking at random a red counter and picking at random a yellow counter.

Colour	red	blue	green	yellow
Probability	0.24			0.32

The probability of picking a blue counter is the same as the probability of picking a green counter.

Complete the table.

(2)

Question 18

Correct to 2 significant figures, the area of a rectangle is 320 cm^2 .

Correct to 2 significant figures, the length of the rectangle is 25 cm.

Calculate the lower bound for the width of the rectangle.

Write down all the numbers on your calculator display.

..... cm
(3)

Question 19

Solve the simultaneous equations

$$x^2 + y^2 = 25$$

$$y = 2x - 5$$

$$x = \dots\dots\dots, y = \dots\dots\dots$$

$$x = \dots\dots\dots, y = \dots\dots\dots$$

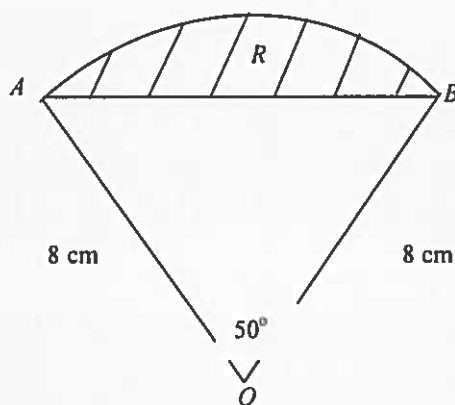
(5)

Question 20

Here is a sector of a circle, with centre at O .

The radius of the circle is 8 cm.

The angle at the centre of the circle is 50° .



- (a) Calculate the length of the arc AB .
Give your answer correct to 2 d.p.

.....
(2)

- (b) Calculate the area of the sector OAB .
Give your answer correct to 2 d.p.

.....
(2)

Question 21

Rationalise the denominators without using a calculator. Leave your answers as surds in their simplest form. Show all your workings.

(a) $\frac{15}{\sqrt{5}}$

.....
(2)

(b) $\frac{2+\sqrt{7}}{2-\sqrt{7}}$

.....
(3)

Question 22

Simplify the following surds without using a calculator. Show all your workings.

(a) $\sqrt{80}$

.....
(2)

(b) $3\sqrt{8} - 4\sqrt{72} =$

.....
(3)

Question 23

Solve the inequality $16 \leq 3x+4 < 2x+11$.

Show your solution on a number line.

(3)

Question 24

In a sale, normal prices are reduced by 20%.

The sale price of a coat is £52

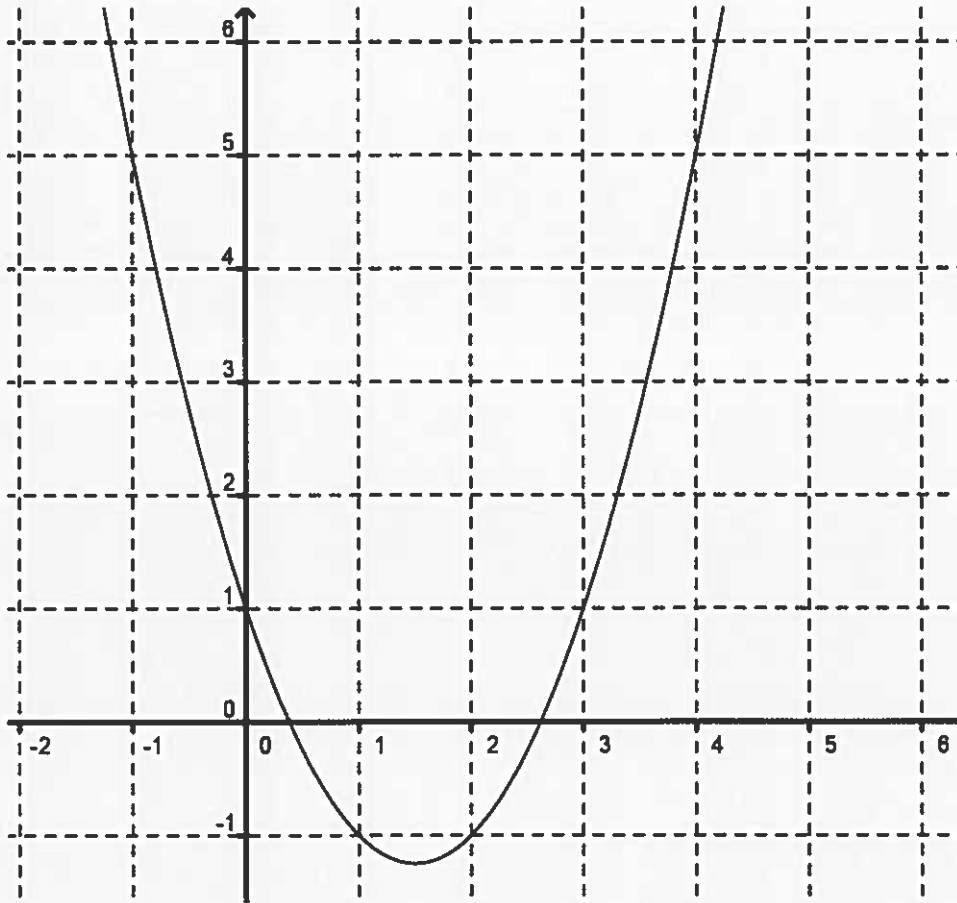
Work out the normal price of the coat.

£

(3)

Question 25

The graph of $y = x^2 - 3x + 1$ is drawn below.



By drawing a line on the graph, solve the equation

$$x^2 - 3x + 1 = 5$$

$x = \dots\dots\dots$, $x = \dots\dots\dots$

(2)

Question 26

(a) Express the following numbers as products of their prime factors.

(i) 120

.....
(2)

(ii) 156

.....
(2)

(b) Find the Highest Common Factor of 120 and 156.

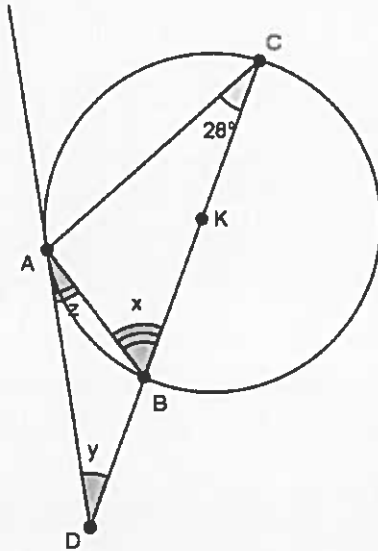
.....
(2)

(c) Work out the Lowest Common Multiple of 120 and 156.

.....
(2)

Question 27

A, B, C are points on the circumference of the circle with centre K.
DA is tangent to the circle at point A.



(a) (i) Work out the size of the angle x.

(ii) Give reason.....
.....

(b) (i) Work out the size of the angle y.

(ii) Give reason.....
.....

(c) (i) Work out the size of the angle z.

(ii) Give reason.....
.....

(6)

Question 28

Given that $x^2 - 6x - 7 = (x + p)^2 + q$ for all values of x .

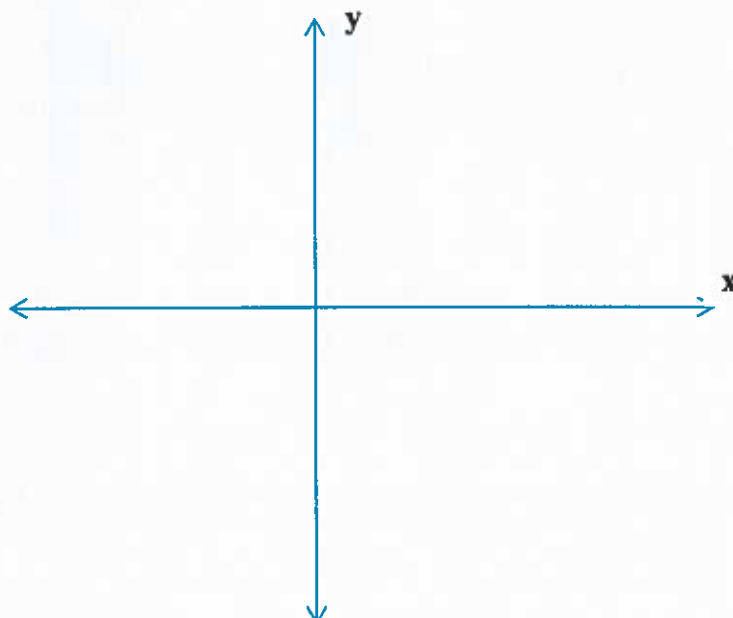
- (a) Use completing the square to find the value of p and the value of q and find the coordinates of the minimum point of the curve.

$p = \dots\dots\dots$

$q = \dots\dots\dots$

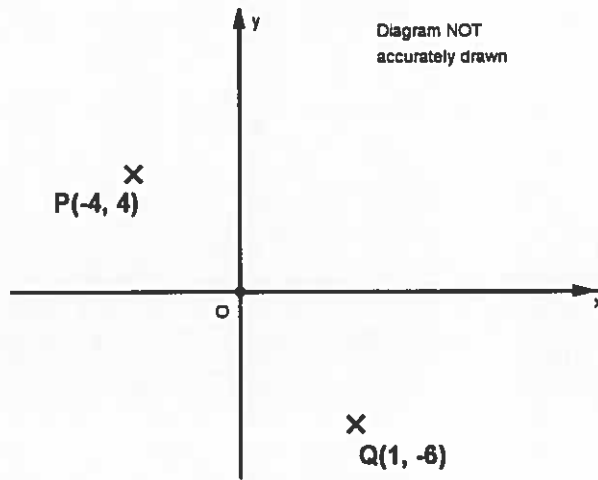
(2)

- (b) Hence on the axis below, draw a sketch of the graph $y = x^2 - 6x - 7$ clearly showing the coordinates of the minimum and any points of intersection with the x and y -axes.



(3)

Question 29



P is the point $(-3, 5)$
Q is the point $(1, -3)$

(a) Find the gradient of PQ .

$$m = \dots\dots\dots$$

(2)

(b) Find the coordinates of the midpoint of PQ .

$$\left(\dots\dots\dots, \dots\dots\dots \right)$$

(1)

(c) Find the equation of the *perpendicular bisector* of the line PQ .

$$y = \dots\dots\dots$$

(2)

Question 30

The diagram below shows a large rectangle of length $(2x + 6)$ cm and width x cm. A smaller rectangle of length x cm and width 4 cm is cut out and removed.

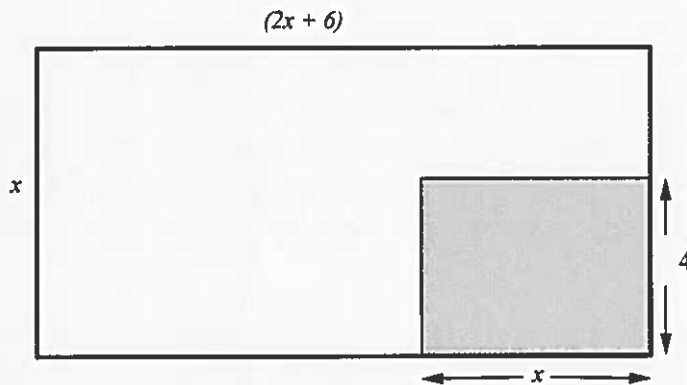


Diagram NOT
accurately drawn

The area of the shape that is left is 55 cm^2 .

(a) Show that

$$2x^2 + 2x - 55 = 0$$

(2)

(b) Solve the equation to calculate the length of the smaller rectangle.
Give your answer correct to 3 significant figures.

..... cm
(2)

TOTAL FOR PAPER: 130 MARKS

END