Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTER NUMBER		CANDIDATE NUMBER	

MATHEMATICS (US)   **0444/33**

Paper 3 (Core)   **October/November 2016**

                                                                    2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
                             Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If work is needed for any question it must be shown in the space provided.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant digits.
Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 104.

Write your calculator model in the box below.

This document consists of **16** printed pages.

International Examinations

[Turn over

Formula List

Area, A, of triangle, base b, height h.	$A = \frac{1}{2}bh$
Area, A, of circle, radius r.	$A = \pi r^2$
Circumference, C, of circle, radius r.	$C = 2\pi r$
Lateral surface area, A, of cylinder of radius r, height h.	$A = 2\pi rh$
Surface area, A, of sphere of radius r.	$A = 4\pi r^2$
Volume, V, of prism, cross-sectional area A, length l.	$V = Al$
Volume, V, of cylinder of radius r, height h.	$V = \pi r^2 h$
Volume, V, of sphere of radius r.	$V = \frac{4}{3}\pi r^3$

3

1 **(a) (i)** Write down the two square numbers between 50 and 99.

.... and .... [2]

(ii) Find a common multiple of 30 and 45.

.... [1]

(iii) Write down all the factors of 54 that are odd numbers.

.... [2]

(iv) Find the greatest common factor (GCF) of 64 and 80.

.... [2]

(b) Calculate

(i) $\sqrt[3]{\dfrac{729}{64}}$,

.... [1]

(ii) $\dfrac{17}{15.6 + 18.4}$,

.... [1]

(iii) 0.2^{-4},

.... [1]

(iv) $3\dfrac{1}{5} \div 2\dfrac{3}{7}$, giving your answer as a decimal correct to 4 significant digits.

.... [2]

4

2 **(a)** Juan takes his car to a garage for repairs.

Complete his bill.

Item	Price ($)
Service	475.00
3 tyres at $86 each	....
4.5 liters of oil at $5.68 per liter	....
Total	....

[3]

(b) Juan buys a van costing $4400.
He pays a deposit of $3740.

(i) Work out $3740 as a percentage of $4400.

.... % [1]

(ii) He borrows the rest of the money for one year at a rate of 12% per year simple interest.

Work out how much he pays back at the end of one year.

$.. [3]

5

(c) Juan pays $321 for insurance.
He makes 12 equal payments.

Work out each payment.

$... [1]

(d) Juan's car travels 12.4 km and uses 1 liter of fuel.
His van travels 1 km and uses 0.0792 liters of fuel.

Using 1 liter of fuel, which vehicle travels further?
Explain how you decide.

.... travels further because ....

.... [2]

(e) In 2015 the total cost of repairs and fuel for his van was $4200.
These costs are in the ratio   repairs : fuel = 1 : 2.

Find the cost of the fuel.

$... [2]

6

3 Eight athletes compete in both the 200 meter race and the long jump.
Their results are shown in the table.

Time for 200 m (seconds)	23.85	23.91	23.92	23.96	24.02	24.15	24.23	24.30
Distance in the long jump (meters)	6.42	6.32	6.24	6.18	6.05	5.97	5.90	5.84

(a) **(i)** Work out the range of the times for the 200 meter race.

.... s [1]

(ii) Work out the mean of the distances in the long jump.

.... m [2]

(b) **(i)** Complete the scatter diagram.
The first four points have been plotted for you.
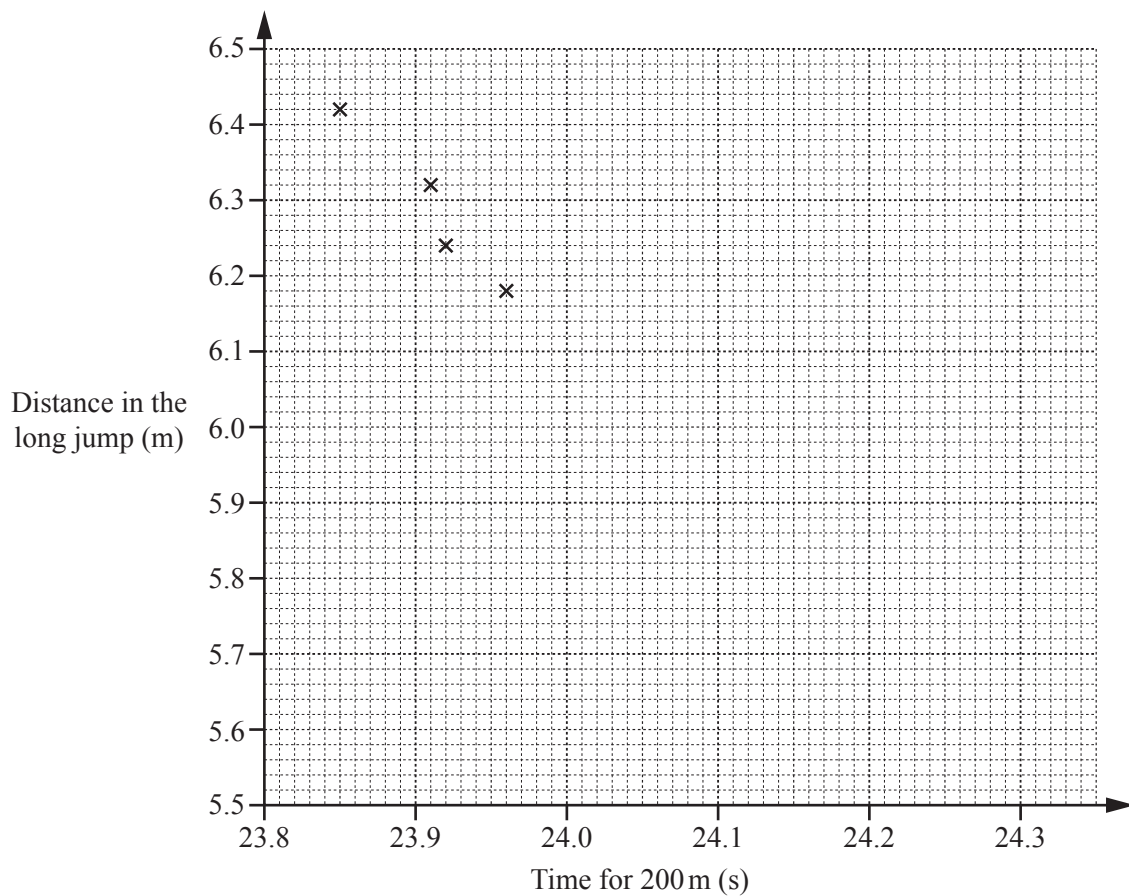
[2]

(ii) What type of correlation is shown on the scatter diagram?

.... [1]

(iii) Joe says that the scatter diagram shows that the faster an athlete runs the 200 meter race the shorter their distance in the long jump.
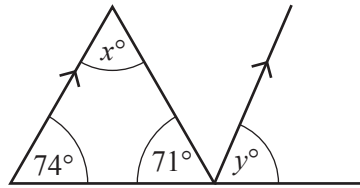
Is he correct?
Explain your answer.

.... because ....

.... [1]

(iv) Draw a line of best fit on the scatter diagram. [1]

(v) Jessica's time for the 200 meter race is 24.05 s.

Use your line of best fit to estimate her distance in the long jump.

.... m [1]

4   **(a)**

NOT TO
SCALE

Work out the value of

(i) x,

$x =$ .... [1]

(ii) y.

$y =$ .... [1]

(b)
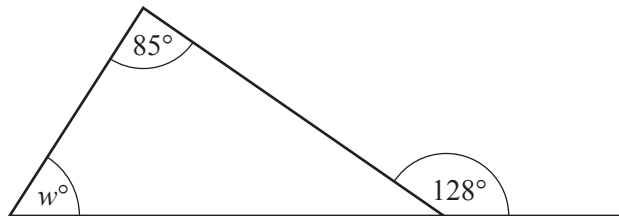
NOT TO
SCALE

Work out the value of w.
Give reasons for your answer.

$w =$ .... because ....

.... [3]

(c)

NOT TO
SCALE

8

15

$p°$
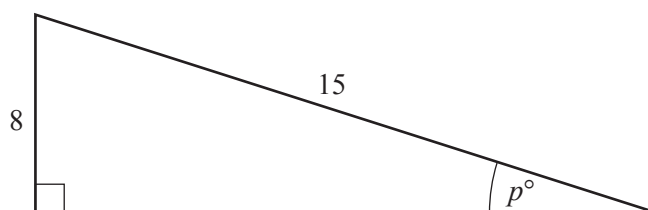
Use trigonometry to calculate the value of p.

$p =$ .... [2]

(d)
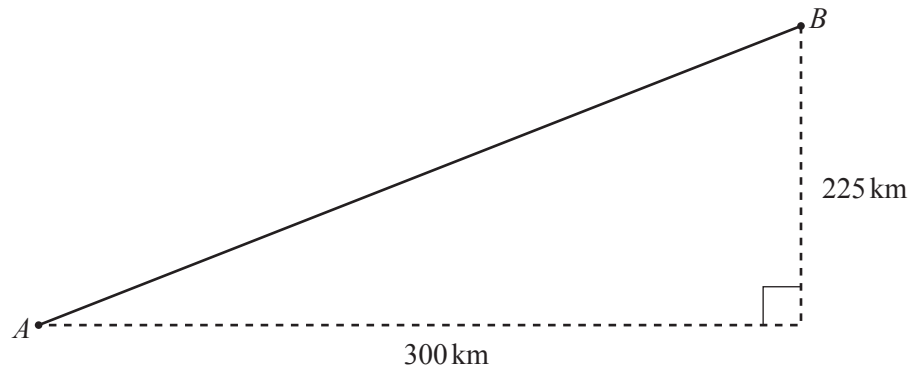
The diagram shows the path of a plane from airport *A* to airport *B*.

(i) Show that the distance between *A* and *B* is 375 km.

[2]

(ii) The plane flies at an average speed of 450 km/h.
It leaves *A* at 14 45 and flies directly to *B*.

Work out the time it arrives at *B*.

.... [4]

10

5   *A*, *B* and *C* are three towns.
   B is 24 km due North of *A*.
   C is 18 km from *A* on a bearing of 039°.

   (a) Make a scale drawing to show the positions of town *B* and town *C*.
   Town *A* has been marked for you.
   Use a scale of 1 centimeter to represent 3 kilometers.

   North

   A •   Scale: 1 cm to 3 km

                                                                                                              [3]

   (b) Using your scale drawing, find the actual distance from town *B* to town *C*.

                                                                                          .... km [1]

   (c) Town *D* is on a bearing of 023° from town *A*.

   Work out the bearing of town *A* from town *D*.

                                                                                          .... [2]

6 **(a)** Here is a list of ingredients to make 18 chocolate chip biscuits.

> butter   130 g
> sugar   60 g
> flour   180 g
> chocolate chips   30 g

Work out how much of each ingredient is needed to make 45 biscuits.

butter .... g

sugar .... g

flour .... g

chocolate chips .... g [3]

(b) In a recipe for bread, $\frac{5}{8}$ of the mass of bread mixture is flour.
Paul uses 395 g of flour.

(i) What mass of bread mixture does he make?

.... g [2]

(ii) Write your answer to **part(b)(i)** in kilograms.

.... kg [1]

(c) Jenny is baking a cake.
The temperatures on Jenny's oven are marked in degrees Fahrenheit (°F).
Jenny's recipe book gives temperatures in degrees Celsius (°C).
She uses this rule to convert the temperature from degrees Celsius to degrees Fahrenheit.

Multiply the temperature in degrees Celsius by 9, add 160 and then divide the answer by 5.

(i) Write this rule as an expression in *C*, where *C* is the temperature in degrees Celsius.

.... [2]

(ii) Jenny's cake must be baked at 180 °C.
Calculate the temperature, in degrees Fahrenheit, at which Jenny should bake her cake.

.... °F [1]

7 **(a)** A regular hexagon has side length h.

Write down an expression, in terms of h, for the perimeter of the hexagon.

.... [1]

(b) A square has side length x.

Write down an expression, in terms of x, for

   (i) the perimeter of the square,

.... [1]

   (ii) the area of the square.

.... [1]

(c) In this part, all measurements are in centimeters.

$(2x + 1)$

$(x + 3)$ NOT TO SCALE
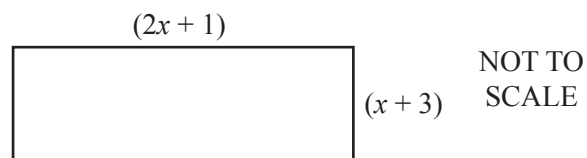
A rectangle has length $(2x + 1)$ and width $(x + 3)$.
The perimeter of the rectangle is 53.

Work out the value of x.

$x =$ .... [5]

(d) **(i)** $12a - 3b + c$

Write down the coefficient of b.

.... [1]

(ii) Simplify.
$$5a + 4b - 2a - b + 3a - 2b$$

.... [2]

(e) Expand.

(i) $5(x - 4)$

.... [1]

(ii) $x(x^2 + 3)$

.... [2]

(f) Factor completely.
$$8x^2 - 4x$$

.... [2]

8
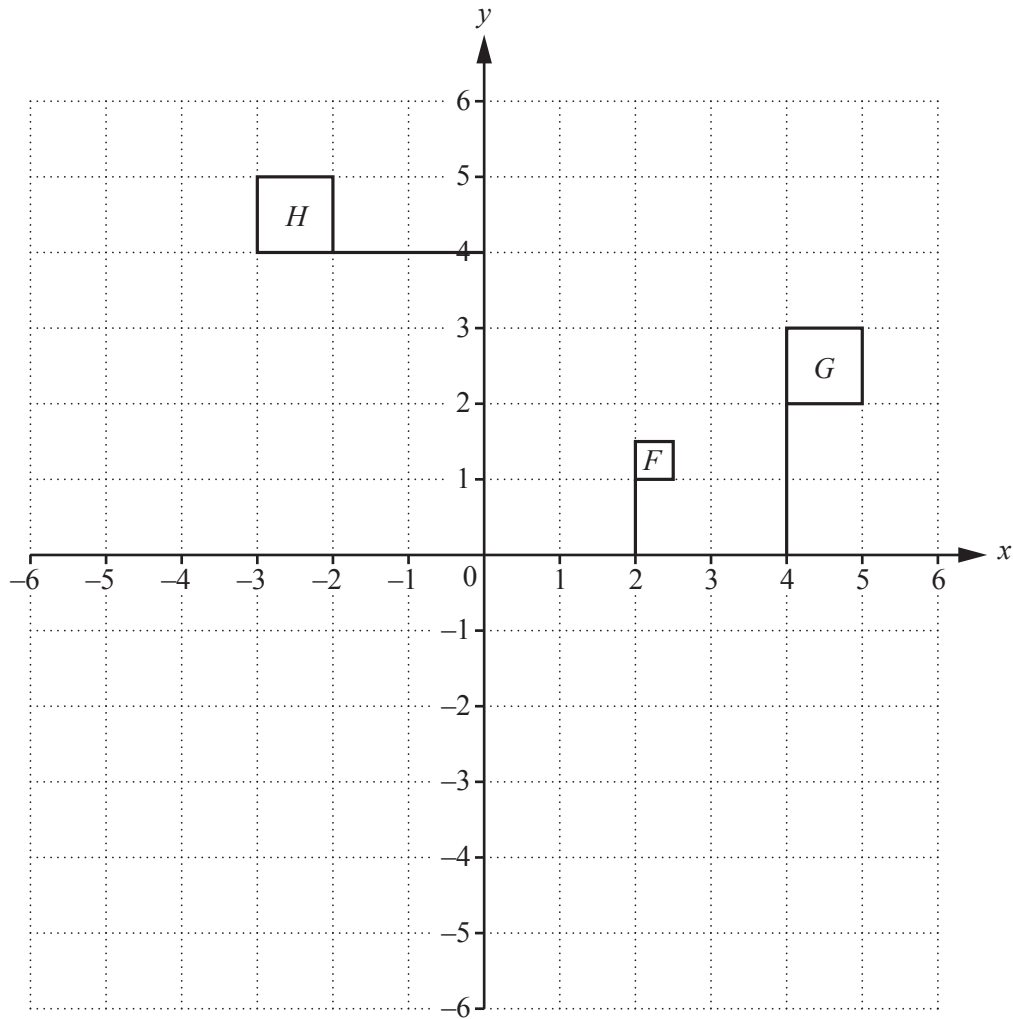
(a) Reflect flag *H* in the *x*-axis. [1]

(b) Translate flag *G* by the vector $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$. [2]

(c) Describe fully the **single** transformation that maps flag *G* onto flag *H*.

....

.... [3]

(d) Describe fully the **single** transformation that maps flag *F* onto flag *G*.

....

.... [3]

9 **(a)** Complete the table of values for $y = x^2 - 2x$.

x	-3	-2	-1	0	1	2	3	4
y			3		-1		3	

[3]

(b) On the grid, draw the graph of $y = x^2 - 2x$ for $-3 \leqslant x \leqslant 4$.
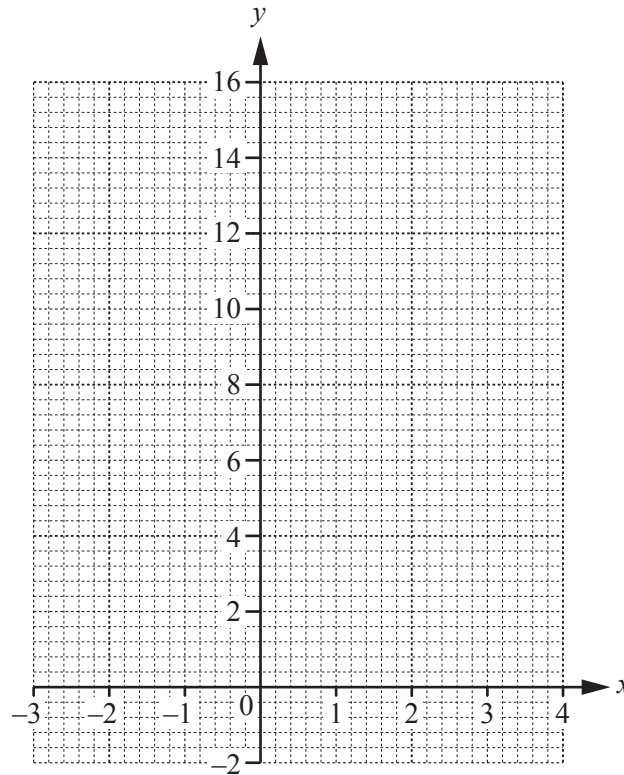
[4]

(c) On the grid, draw the line $y = 6$. [1]

(d) Use your graph to solve the equation $x^2 - 2x = 6$.
Give your answers correct to 1 decimal place.

$x =$ .... or $x =$ .... [2]

Question 10 is printed on the next page.

10 $f(x) = 3x - 5$ for values of x greater than 0 and less than 10.

   (a) Write the domain of this function using mathematical symbols.

   .... [2]

   (b) Work out the range of this function.

   .... $< f(x) <$ .... [2]

   (c) Find and simplify an expression for $f\left(\dfrac{x}{3}\right)$.

   .... [1]

   (d) Solve $f(x) = 7$.

   $x =$ .... [2]

   (e) The graph of $y = f(x)$ is mapped onto the graph of $y = g(x)$ by a translation with vector $\begin{pmatrix} -4 \\ 0 \end{pmatrix}$.

   Put a ring around the correct statement.

   $g(x) = f(x) + 4$ $g(x) = f(x + 4)$ $g(x) = f(x - 4)$ $g(x) = f(x) - 4$

   [1]