OCR-H May '22 P4

Answer **all** the questions.

1 **(a)** Write 6 050 000 in standard form.

6.05×10^6 ✓

(a) ..... **[1]**

(b) Write 4.58×10^{-3} as an ordinary number.

0.00458 ✓

(b) ..... **[1]**

2 Calculate.

$$\frac{270}{2.5^2} - \frac{4.6 + 17.2}{8.4 - 6.8}$$

$\frac{216}{5}$ or $\frac{109}{8}$ ✓

29.575 ✓

..... **[2]**

3 In January 2018, an art collector bought an antique painting.
In January 2020, he sold it for £17 640.

Assume the value of the painting increased by 5% each year.

Calculate the art collector's profit.
You must show your working.

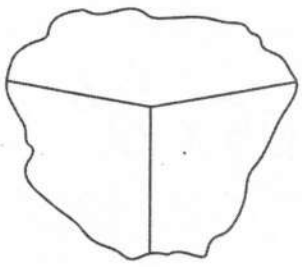
✓ ✓ ✓

$17640 \div 1.05^2 = 16000$ ✓

$17640 - 16000$

£ 1640 ✓ **[5]**

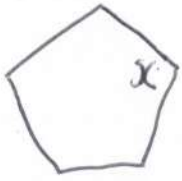
4 Three **regular** polygons meet at a point.



Not to scale

Two of the polygons are pentagons.

Find the number of sides of the third polygon.
You must show your working.



$x = \frac{(5-2)\times 180}{5} = 108$ ✓ ✓

$360 - 2\times 108 = 144 = \text{internal}$ ✓

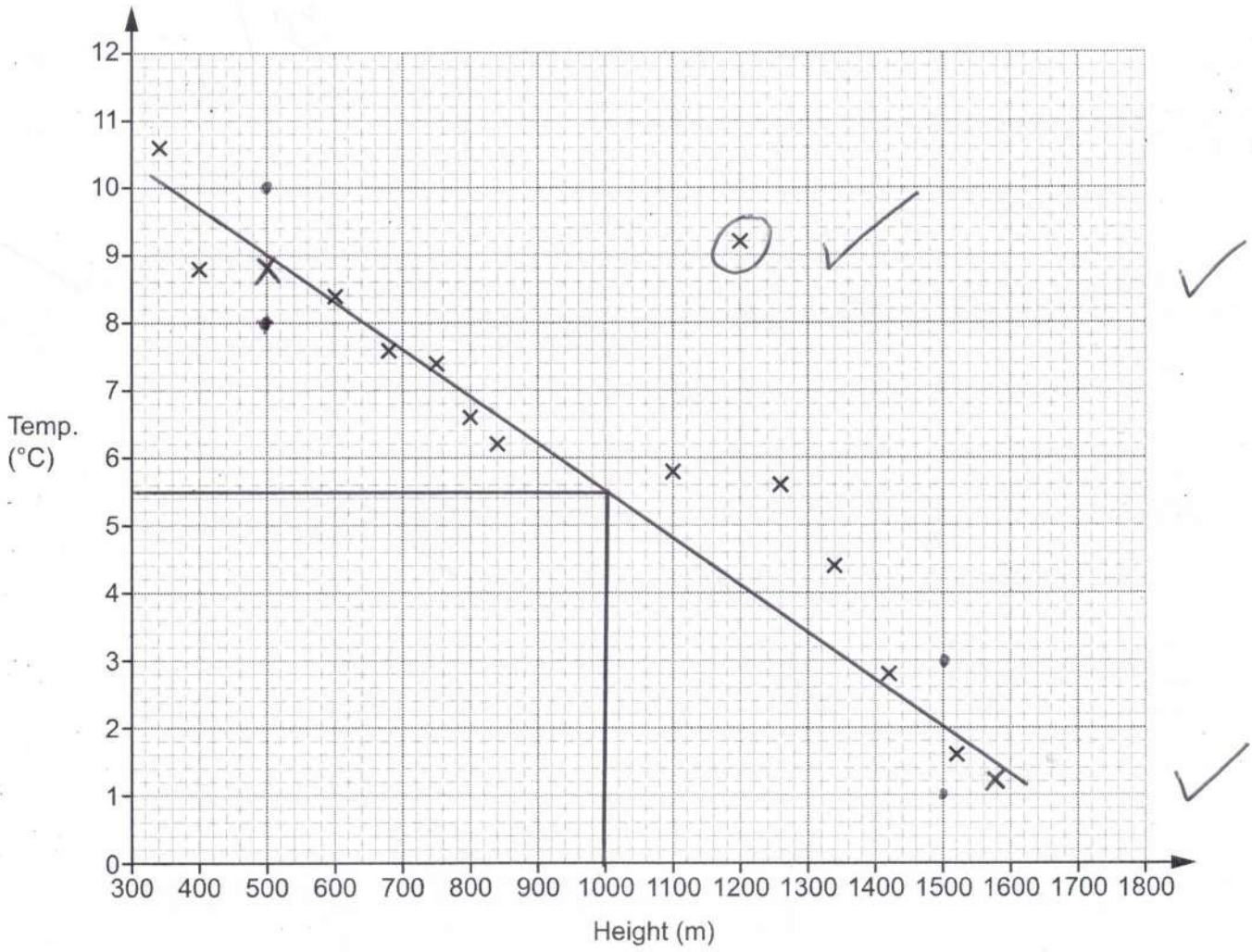
$\text{external} = 36$ ✓

$n = \frac{360}{36}$ ✓

10 ✓

..... [6]

5 The scatter diagram shows the midday temperature at 13 different heights on a mountain.



(a) The table has the information for 2 more heights.

Plot these on the scatter diagram.

Height (m)	500	1580
Temperature (°C)	8.8	1.2

[2]

(b) Describe the type of correlation shown in the scatter diagram.

(b) negative [1]

[ms 5 → 6.5]

(c) By drawing a line of best fit, estimate the temperature at 1000 m.

(c) 5.7 ✓ °C **[2]**

(d) Circle the outlier on the scatter diagram. **[1]**

(e) Explain why using the scatter diagram to estimate the temperature at 1800 m may be unreliable.

no data > 1580 ✓

or similar

[1]

(f) Find the percentage of the 15 temperatures which are below 6 °C.

✓ $\frac{6}{15} \times 100$ ✓

(f) 40 ✓ % **[3]**

6 A machine can dig, on average, 2 cm of tunnel each minute.
It operates 24 hours each day.

(a) Work out how many days it should take to dig a tunnel of length 3.5 km.
Give your answer to the nearest day.

$$\frac{3.5 \times 1000 \times 100}{2 \times 60 \times 24}$$

$= 121.5...$

122

(a) ..... days **[4]**

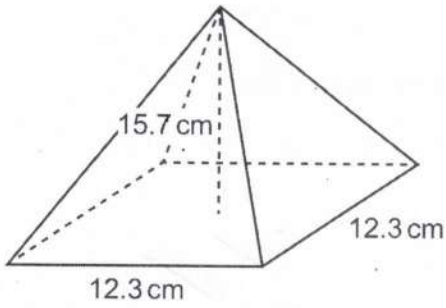
(b) The machine actually digs an average of 2.5 cm of tunnel each minute for most of the time and an average of 1.5 cm each minute for the rest of the time.

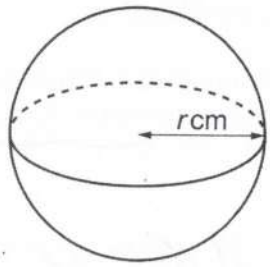
How would this affect your answer to part **(a)**?

It will take less time

..... **[1]**

7 The diagram shows a square-based pyramid and a sphere.





The pyramid has base length 12.3 cm and perpendicular height 15.7 cm.
The sphere has radius r cm.

The pyramid and the sphere have the same volume.

Work out the radius of the sphere.
You must show your working.

[The volume of a pyramid is $\frac{1}{3}$ × area of base × perpendicular height.

The volume V of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$V_p = \frac{1}{3} \times 12.3^2 \times 15.7 = 791.751$ ✓

$V_s = \frac{4}{3} \times \pi \times r^3 = 791.751$ ✓

$r = \sqrt[3]{189.01...}$ ✓

$= 5.7389...$

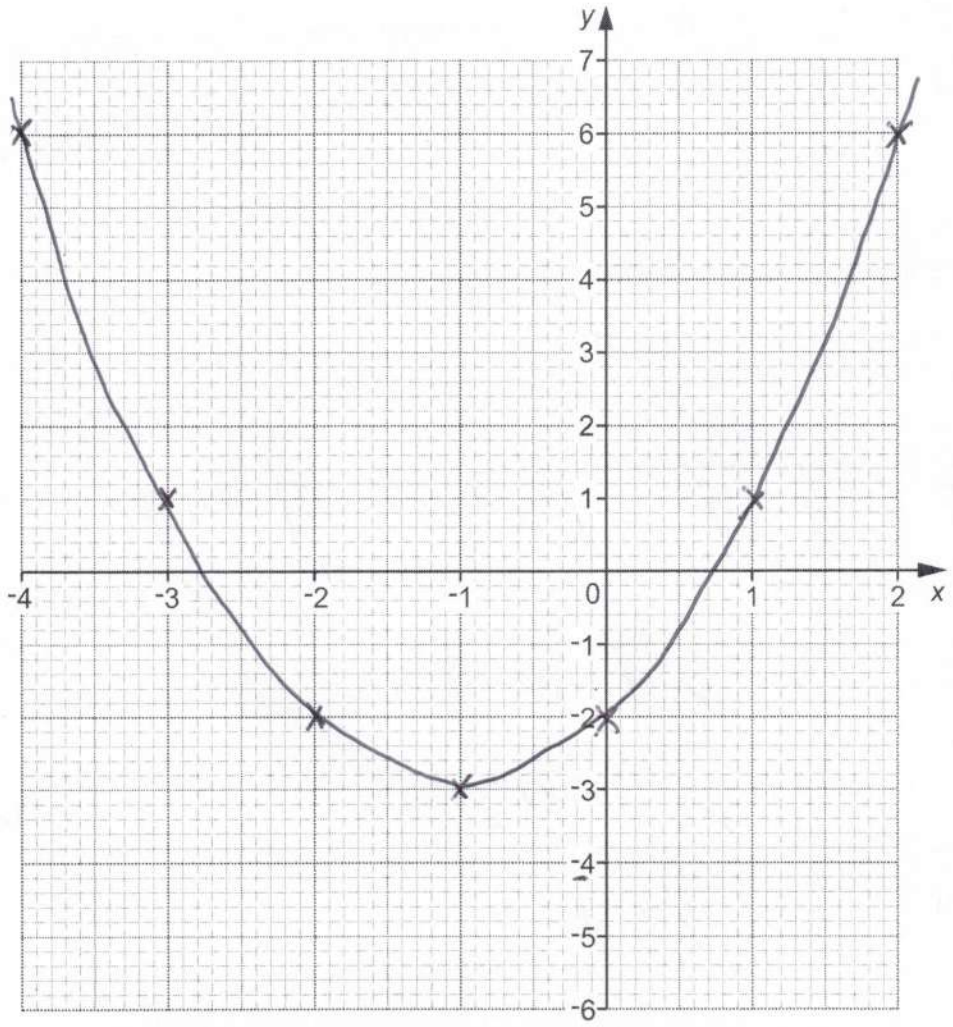
5.74 ✓

..... cm **[5]**

8 Here is a table of values for $y = x^2 + 2x - 2$.

x	-4	-3	-2	-1	0	1	2
y	6	1	-2	-3	-2	1	6

(a) Draw the graph of $y = x^2 + 2x - 2$ for $-4 \leqslant x \leqslant 2$.



✓4 ✓6 ✓

[3]

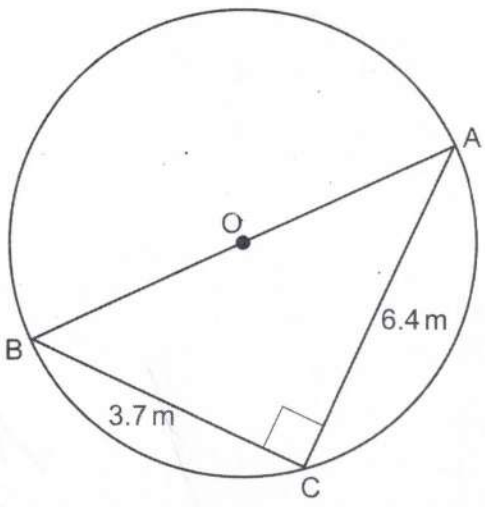
(b) Write down the equation of the line of symmetry of the graph.

(b) $x = -1$ ✓ **[1]**

(c) Use the graph to solve the equation $x^2 + 2x - 2 = 0$.
Give your answers to **1** decimal place.

(c) $x =$ -2.8 or -2.7 ✓ or $x =$ 0.7 or 0.8 ✓ **[2]**

9 Points A, B and C lie on the circumference of a circle, centre O.



Not to scale

Angle ACB = 90°, AC = 6.4 m and BC = 3.7 m.

Work out the circumference of the circle.
You must show your working.

$AB = \sqrt{3.7^2 + 6.4^2} = 7.392...$ ✓✓

$C = \pi \times \text{diameter}$

$= \pi \times 7.392$ ✓✓

$= 23.224...$

23.2 ✓

..... m **[5]**

10 A student is researching the difference in how much exercise adults and children do.
To collect their data, the student interviews the first 25 people found in the High Street at 11 am on one Monday morning.

(a) Make **three** different criticisms of the student's method of collecting data.

1 Small sample ✓

2 Sample isn't random, may not see any 'workers' / children ✓

3 Can't ensure spread of adults / children ✓

[3]

(b) Here is the data collection table that the student used.

Hours exercised in a week (h)	Adult tally	Child tally
$0 \leqslant h \leqslant 2$		
$2 \leqslant h \leqslant 4$		
$4 \leqslant h \leqslant 8$		
$8 \leqslant h \leqslant 12$		
$12 \leqslant h \leqslant 20$		

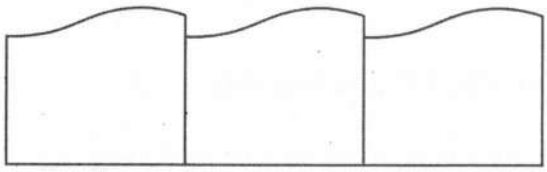
Make **one** criticism of the student's table.

Groups overlap ✓

[1]

11 Jamie buys fence panels that fit tightly together.

Not to scale



Each panel has a length of 1.8 m, correct to 1 decimal place.
Jamie measures the length of a garden as 42 m, correct to the nearest metre.

Work out the minimum number of panels Jamie should buy in order to be certain that there are enough panels for the length of the garden.
Show how you decide.

$1.8 < 1.85$
$1.8 < 1.75$

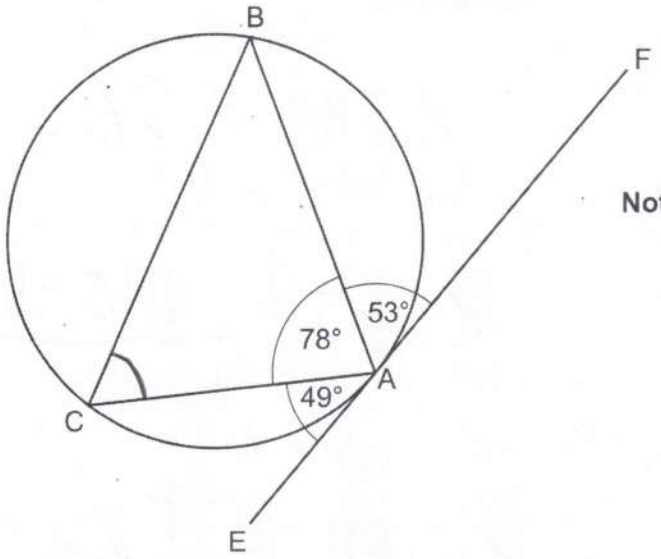
$42 < 42.5$
$42 < 41.5$

$42.5 \div 1.75 = 24.2...$ ✓ ✓ ✓

25 ✓

..... **[4]**

12 (a) Points A, B and C lie on the circumference of a circle.
EAF is a tangent to the circle.



Not to scale

Write down the value of angle BCA giving a reason for your answer.

Angle BCA = 53° because alternate segment theorem

[2]

5 8 7

13 Here is a restaurant's menu.

Starter	Main	Dessert
Prawn Cocktail	Hunter's Chicken	Trifle
Duck Spring Rolls	Beef Curry	Ice Cream
Lamb Meatballs	Steak	Cheesecake
Leaf Salad (V)	Fish Pie	Chocolate Cake
Mushroom Soup (V)	Lasagne	Bakewell Tart
	Egg Salad (V)	Fruit Salad (V)
	Vegetable Hot Pot (V)	Cherry Pie (V)
	Macaroni Cheese (V)	

(V) denotes vegetarian

2 3 2

(a) A 3-course meal consists of one starter, one main and one dessert.

Work out how many different 3-course meals can be chosen from the menu.

$5 \times 8 \times 7$ ✓

(a) 280 ✓ ..... **[2]**

(b) Find the fraction of the 3-course meals which are completely vegetarian (V).

$2 \times 3 \times 2 = 12$ ✓

(b) $\frac{12}{280}$ ✓OE ..... **[2]**

14 $(x+2)(3x+a)(bx+3) = 6x^3 + 11x^2 - 17x - 30$

Find the value of a and the value of b.

$2 \times a \times 3 = -30$

$a = -30 \div 6$

$1 \times 3 \times b = 6$

$b = \frac{6}{3}$

$a =$ -5 ✓

$b =$ 2 ✓ **[2]**

15 Use algebra to prove that an odd number multiplied by a different odd number always gives an answer that is an odd number. **[4]**

$(2n+1)(2m+1)$ ✓

$= 4nm + 2n + 2m + 1$ ✓✓

$= 2(2nm + n + m) + 1$

$=$ Even (multiple of 2) $+1$ $=$ odd ✓

16 Li bought a house at the start of 2016.
Li assumes the value of the house, £V, can be predicted using the formula

$V = 185000 \times 1.035^n$

where n is the number of years after the start of 2016.

(a) Explain how you know that the value of the house is predicted to increase each year.

1·035 > 1 ✓

..... **[1]**

(b) Write down the percentage increase per year that is used in the formula.

3·5 ✓

(b) ..... % **[1]**

(c) Write down the value of the house at the start of 2016.

185000 ✓

(c) £ ..... **[1]**

(d) Calculate the predicted value of the house at the start of 2020, giving your answer correct to **4** significant figures.

185000×1.035^4 ✓

$= 212291...$

(d) £ 21230 ✓ **[2]**

(e) **(i)** Compared with its value at the start of 2016, show that the formula predicts the house will have doubled in value at some point during 2036. **[3]**

$185000 \times 2 = 370000$

$185000 \times 1.035^{20} = 368110$ ✓✓

$185000 \times 1.035^{21} = 380994$ ✓

(ii) Give **one** reason why this may not happen.

Trend / rate of increase may not continue ✓

..... **[1]**

17 There are 15 sweets in a bag.
10 of the sweets are toffee and 5 are mint.
Reece takes two of the sweets at random.

Work out the probability that Reece takes one of each type of sweet.

1 of each = TM + MT

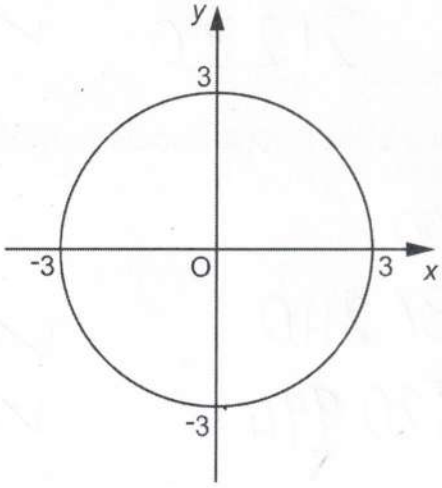
$= 2 \times \frac{10}{15} \times \frac{5}{14} = \frac{100}{210}$ ✓OE

✓ ✓ ✓

$\frac{10}{21}$ etc

..... **[4]**

18 The diagram shows a circle, centre the origin.



Write down the equation of the circle.

✓ ✓

$x^2 + y^2 = 9$

..... **[2]**

19 **(a)** Write as a single fraction in its simplest form.

$$\frac{4}{2n+3} - \frac{2n}{n^2+1}$$

$$= \frac{4(n^2+1) - 2n(2n+3)}{(2n+3)(n^2+1)} \quad \checkmark \quad \checkmark$$

$$= \frac{4n^2+4-4n^2-6n}{(2n+3)(n^2+1)} \quad \checkmark$$

$$= \frac{4-6n}{(2n+3)(n^2+1)} \quad \checkmark$$

(a) ..... **[4]**

(b) Simplify.

$$\frac{x^2 - x - 12}{2x^2 - 3x - 20}$$

$$= \frac{(x+3)(x-4)}{(2x+5)(x-4)}$$ ✓✓ ✓✓

$$\frac{x+3}{2x+5}$$ ✓

(b) ..... **[5]**

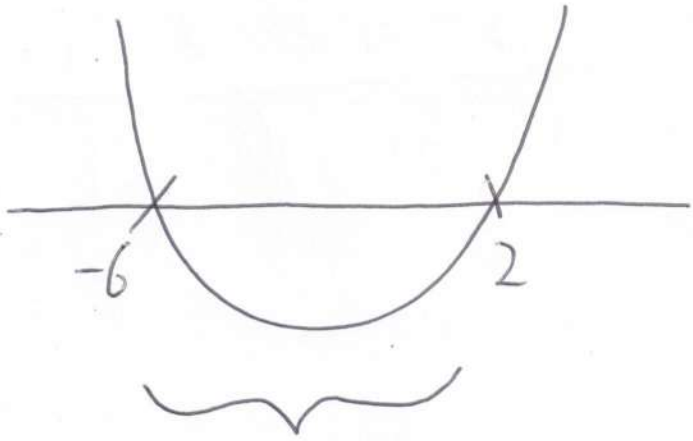
TURN OVER FOR QUESTION 20

20 Solve this inequality.

$x^2 + 4x - 12 \leqslant 0$

Give your answer using set notation.
You must show your working.

$(x+6)(x-2) \leqslant 0$ ✓✓



✓

$-6 \leqslant x \leqslant 2$ ✓✓

..... **[5]**

END OF QUESTION PAPER