

**Instructions**

* Use **black** ink or ball-point pen.
* **Fill in the boxes** at the top of this page with your name,
centre number and candidate number.
* Answer **all** questions.
* Answer the questions in the spaces provided

– *there may be more space than you need*.

* **Calculators may be used.**
* If your calculator does not have a *π* button, take the value of *π* to be
3.142 unless the question instructs otherwise.
* Diagrams are **NOT** accurately drawn, unless otherwise indicated.
* You must **show all your working out**.

**Information.**

* The total mark for this paper is 80.
* The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question*.

**Advice**

* Read each question carefully before you start to answer it.
* Keep an eye on the time.
* Try to answer every question.
* Check your answers if you have time at the end.

**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

**1**



Describe the single transformation that maps shape **A** onto shape **B**.

......................................................................................................................................................

......................................................................................................................................................

**(Total for Question 1 is 2 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2** The time series graph shows information about the percentages of the people in a village

that used the village shop for the years between 1980 and 2010.



(*a*) Describe the trend in the percentage of the people in the village who used the shop

 for this period.

......................................................................................................................................................

**(1)**

(*b*) (i) Use the graph to predict the percentage of the people in the village likely to use

 the shop in the year 2020.

.......................................................%

 (ii) Is your prediction reliable?

 Explain your answer.

......................................................................................................................................................

......................................................................................................................................................

**(3)**

**(Total for Question 2 is 4 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**3** (*a*) Expand and simplify 3(*y* − 2) + 5(2*y* + 1)

.......................................................

**(2)**

(*b*) Simplify 5*u*2*w*4 × 7*uw*3

.......................................................

**(2)**

**(Total for Question 3 is 4 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**4**

**

The diagram shows a regular octagon and a regular hexagon.

Find the size of the angle marked *x*

You must show all your working.

*x* = ....................................................... °

**(Total for Question 4 is 3 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**5**Here is a Venn diagram.



(*a*) Write down the numbers that are in set

 (i) *A* ∪ *B*

.......................................................

 (ii) *A* ∩ *B*

.......................................................

**(2)**

One of the numbers in the diagram is chosen at random.

(*b*) Find the probability that the number is in set *A*ʹ

.......................................................

**(2)**

**(Total for Question 5 is 4 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**6**On a farm

 the number of cows and the number of sheep are in the ratio 6 : 5

 the number of sheep and the number of pigs are in the ratio 2 : 1

The total number of cows, sheep and pigs on the farm is 189.

How many sheep are there on the farm?

.......................................................

**(Total for Question 6 is 3 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**7**

****

The arc *ABC* is a quarter of a circle with centre *O* and radius 4.8 cm.

*AC* is a chord of the circle.

Work out the area of the shaded segment.

Give your answer correct to 3 significant figures.

.......................................................cm2

**(Total for Question 7 is 3 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**8** Steve is asked to solve the equation 5(*x* + 2) = 47

Here is his working.

5(*x* + 2) = 47

 5*x* + 2 = 47

 5*x* = 45

 *x* = 9

Steve’s answer is wrong.

(*a*)What mistake did he make?

......................................................................................................................................................

......................................................................................................................................................

**(1)**

Liz is asked to solve the equation 3*x*2 + 8 = 83

Here is her working.

3*x*2 + 8 = 83

 3*x*2 = 75

 *x*2 = 25

 *x* = 54

(*b*)Explain what is wrong with Liz’s answer.

......................................................................................................................................................

......................................................................................................................................................

**(1)**

**(Total for Question 8 is 2 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**9** The functions f and g are such that

f(*x*) = 3(*x* – 4) and g(*x*) =  + 1

(*a*) Find the value of f(10)

.......................................................

**(1)**

(*b*)Find g–1(*x*)

g–1(*x*) = .......................................................

**(2)**

(*c*)Show that ff(*x*) = 9*x* – 48

**(2)**

**(Total for Question 9 is 5 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**10** The population of a city increased by 5.2% for the year 2014.

At the beginning of 2015 the population of the city was 1 560 000.

Lin assumes that the population will continue to increase at a constant rate of 5.2% each year.

(*a*)Use Lin’s assumption to estimate the population of the city at the beginning of 2017.

 Give your answer correct to 3 significant figures.

.......................................................

**(3)**

(*b*)(i) Use Lin’s assumption to work out the year in which the population of the city will

 reach 2 000 000.

.......................................................

 (ii) If Lin’s assumption about the rate of increase of the population is too low,

 how might this affect your answer to (*b*)(i)?

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

**(3)**

**(Total for Question 10 is 6 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**11** The cumulative frequency graphs show information about the times taken by 100 male

runners and by 100 female runners to finish the London marathon.



A male runner is chosen at random.

(*a*)Find an estimate for the probability that this runner took less than 4 hours to finish

 the London marathon.

.......................................................

**(2)**

(*b*)Use medians and interquartile ranges to compare the distribution of the times taken

 by the male runners with the distribution of the times taken by the female runners.

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

**(4)**

**(Total for Question 11 is 6 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**12** Marie has 25 cards.

Each card has a different symbol on it.

Marie gives one card to Shelley and one card to Pauline.

(*a*) In how many different ways can Marie do this?

.......................................................

**(2)**

There are 12 boys and 10 girls in David’s class.

David is going to pick three different students from his class and write their names in a

list in order.

The order will be

girl

boy

girl

boy

girl

boy

 **or**

(*b*) How many different lists can David write?

.......................................................

**(3)**

**(Total for Question 12 is 5 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**13** The number of slugs in a garden *t* days from now is *pt* where

 *p*0 = 100

 *pt* + 1 = 1.06*pt*

Work out the number of slugs in the garden 3 days from now.

.......................................................

**(Total for Question 13 is 3 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**14** *D* is directly proportional to the cube of *n*.

Mary says that when *n* is doubled, the value of *D* is multiplied by 6.

Mary is wrong.

Explain why.

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

**(1)**

**(Total for Question 14 is 1 mark)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**15** Karol runs in a race.

The graph shows her speed, in metres per second, *t* seconds after the start of the race.



(*a*)Calculate an estimate for the gradient of the graph when *t* = 4

 You must show how you get your answer.

.......................................................

**(3)**

(*b*)Describe fully what your answer to part (*a*)represents.

......................................................................................................................................................

......................................................................................................................................................

**(2)**

(*c*)Explain why your answer to part (*a*)is only an estimate.

......................................................................................................................................................

......................................................................................................................................................

**(1)**

**(Total for Question 15 is 6 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**16** (i) Find the value of 

.......................................................

(ii) Find the value of 

 Give your answer correct to 1 decimal place.

.......................................................

**(Total for Question 16 is 2 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**17**

****

*a* is 8.3 cm correct to the nearest mm

*b* is 6.1 cm correct to the nearest mm

Calculate the upper bound for *c*.

You must show your working.

....................................................... cm

**(Total for Question 17 is 4 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**18** Simplify fully 

.......................................................

**(Total for Question 18 is 3 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**19** (*a*)Sketch the graph of *y* = cos *x*° for 0 ≤ *x* ≤ 360



**(2)**

(*b*)The graph of *y* = f(*x*) is shown on both grids below.

 (i) On this grid, draw the graph of *y* = 2f(*x*)



 (ii) On the grid below, draw the graph of *y* = f(*x* − 3)



**(2)**

**(Total for Question 19 is 4 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**20**

**

*PQRST* is a regular pentagon.

*R*, *U* and *T* are points on a circle, centre *O*.

*QR* and *PT* are tangents to the circle.

*RSU* is a straight line.

Prove that *ST* = *UT.*

**(Total for Question 20 is 5 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**21** Given that

2*x* – 1 : *x* – 4 = 16*x* + 1 : 2*x* − 1

find the possible values of *x*.

.......................................................

**(Total for Question 21 is 5 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**TOTAL FOR PAPER IS 80 MARKS**