Text

Description automatically generated

**Diagram, polygon

Description automatically generatedAnswer ALL TWENTY FOUR questions.**

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

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

**1** The table shows information about the frame size, in cm, of 60 bicycles sold in a shop.

|  |  |
| --- | --- |
| **Frame size (*S* cm)** | **Frequency** |
| 30 < *S* ≤ 36 | 4 |
| 36 < *S* ≤ 42 | 14 |
| 42 < *S* ≤ 48 | 18 |
| 48 < *S* ≤ 54 | 19 |
| 54 < *S* ≤ 60 | 5 |

(*a*)Write down the modal class.

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

**(1)**

(*b*)Work out an estimate for the mean frame size.

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

**(4)**

**(Total for Question 1 is 5 marks)**

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

**2** The diagram shows a solid triangular prism.

Diagram

Description automatically generated

Work out the **total** surface area of the triangular prism.

Give your answer correct to 3 significant figures.

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

**(Total for Question 2 is 3 marks)**

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

**3** Here is a list of six numbers written in order of size.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *x* | 5 | *y* | *z* | 10 | 12 |

The numbers have

a range of 9

a median of 8

a mode of 10

Find the value of *x*, the value of *y* and the value of *z*

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

*y* = ......................................................

*z* = ......................................................

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

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

**4** Divya and Yuan each pay for a holiday at a special offer price.

Graphical user interface, application, Word

Description automatically generated

The amount that Divya pays is the same as the amount that Yuan pays.

Work out the value of *k*

*k* = ......................................................

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

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

**5** *C* grams of chocolate is shared in the ratios 2 : 5 : 8

The difference between the largest share and the smallest share is 390 grams.

Work out the value of *C*

*C* = ......................................................

**(Total for Question 5 is 3 marks)**

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

**6** Solve the simultaneous equations

*x* + 2*y* = 15

4*x* – 6*y* = 4

Show clear algebraic working.

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

*y* = ......................................................

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

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

**7** (*a*)Write 9.32 × 10–5 as an ordinary number.

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

**(1)**

(*b*)Work out 3 × 105 – 6 × 104

Give your answer in standard form.

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

**(2)**

(*c*)Work out (3 × 1055) × (6 × 1065)

Give your answer in standard form.

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

**(2)**

**(Total for Question 7 is 5 marks)**

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

**8** (*a*)Factorise fully 18*c*3*d*2 – 21*c*2

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

**(2)**

(*b*)(i) Factorise *y*2 – 3*y* – 18

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

**(2)**

(ii) Hence, solve *y*2 – 3*y* – 18 = 0

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

**(1)**

**(Total for Question 8 is 5 marks)**

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

**9** The diagram shows an isosceles triangle *ABC*

*Chart

Description automatically generated*

*AB* = 7 cm *AC* = *BC* = *y* cm

The area of the triangle is 42 cm2

Work out the value of *y*

*y* = ......................................................

**(Total for Question 9 is 4 marks)**

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

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

*Diagram

Description automatically generated*

*RT* = 12 cm

*M* is the midpoint of *RT*

Angle *ROM* = 52°

Work out the area of the circle.

Give your answer correct to 3 significant figures.

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

**(Total for Question 10 is 4 marks)**

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

**11** The table shows information about the times, in minutes, that 80 patients had to wait to

see a doctor.

|  |  |
| --- | --- |
| **Time (*W* minutes)** | **Frequency** |
| 0 < *W* ≤ 10 | 7 |
| 10 < *W* ≤ 20 | 10 |
| 20 < *W* ≤ 30 | 15 |
| 30 < *W* ≤ 40 | 32 |
| 40 < *W* ≤ 50 | 16 |

(*a*)Complete the cumulative frequency table below.

|  |  |
| --- | --- |
| **Time (*W m*inutes)** | **Cumulative frequency** |
| 0 < *W* ≤ 10 |  |
| 10 < *W* ≤ 20 |  |
| 20 < *W* ≤ 30 |  |
| 30 < *W* ≤ 40 |  |
| 40 < *W* ≤ 50 |  |

**(1)**

(*b*)On the grid on the next page, draw a cumulative frequency graph for your table.

**Chart

Description automatically generated**

**(2)**

(*c*)Use your graph to find an estimate for the median.

...................................................... minutes

**(1)**

(*d*)Use your graph to find an estimate for the interquartile range.

...................................................... minutes

**(2)**

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

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

**12** Solve 2–4*x* = 32

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

**(Total for Question 12 is 2 marks)**

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

**13** Use algebra to show that 

**(Total for Question 13 is 2 marks)**

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

**14 **

*p* = 0.51 correct to 2 significant figures.

*r* = 6.3 correct to 2 significant figures.

Work out the upper bound for the value of *T*

Show your working clearly.

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

**(Total for Question 14 is 2 marks)**

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

**15** (*a*)Complete the table of values for *y* = *x*3 – 3*x* + 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | –2 | –1 | –0.5 | 0 | 1 | 1.5 | 2 |
| *y* |  | 4 | 3.4 |  | 0 | 0.9 |  |

**(2)**

(*b*)On the grid, draw the graph of *y* = *x*3 – 3*x* + 2 for values of *x* from –2 to 2

Chart

Description automatically generated

**(2)**

(*c*)By drawing a suitable straight line on the grid, use your graph to find an estimate for

the solution of

2*x*3 – 3*x* + 4 = 0

Give your answer correct to one decimal place.

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

**(3)**

**(Total for Question 15 is 7 marks)**

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

**16** The function f is such that



(*a*)Find 

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

**(1)**

(*b*)Find f –1(*x*)

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

**(2)**

The function g is such that

g(*x*) = 5*x*2 – 20*x* + 23

(*c*)Express g(*x*) in the form *a*(*x* – *b*)2 + *c*

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

**(3)**

**(Total for Question 16 is 6 marks)**

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

**17**

*Chart, radar chart

Description automatically generated*

*AB* = 4.6 cm *BC* = 8.3 cm angle *ABC* is acute

The area of triangle *ABC* is 12 cm²

Work out the perimeter of triangle *ABC*

Give your answer correct to 3 significant figures.

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

**(Total for Question 17 is 5 marks)**

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

**18** Solve 

Give your answer in the form  where *a* and *b* are integers.

Show your working clearly.

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

**(Total for Question 18 is 4 marks)**

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

**19** *P* is inversely proportional to *y*2

When *y* = 4, *P* = *a*

(*a*)Find a formula for *P* in terms of *y* and *a*

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

**(3)**

Given also that *y* is directly proportional to *x*

and when *x* = *a*, *P* = 4*a*

(*b*)find a formula for *P* in terms of *x* and *a*

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

**(3)**

**(Total for Question 19 is 6 marks)**

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

**20** Here is a sketch of the curve *y* = *a* cos(*x* + *b*)° for 0 ≤ *x* ≤ 360

Chart, line chart

Description automatically generated

Given that 0 < *b* < 180

find the value of *a* and the value of *b*

*a* = ......................................................

*b* = ......................................................

**(Total for Question 20 is 2 marks)**

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

**21** The diagram shows a triangular prism, *ABCDEF*, with a rectangular base *ABCD*

*Chart, radar chart

Description automatically generated*

*AB* = 6 cm *DE* = 2.2 cm angle *DAE* = 18° angle *ADE* = 90°

Work out the angle that *BE* makes with the plane *ABCD*

Give your answer correct to one decimal place.

......................................................°

**(Total for Question 21 is 4 marks)**

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

**22** The diagram shows triangle *OAB* with *OA* extended to *E*

*A picture containing chart

Description automatically generated*



*M* is the point on *OB* such that *OM* : *MB* = 4 : 1

*N* is the point on *AB* such that *AN* : *NB* = 3 : 2

*OA* : *AE* = 5 : 3

(*a*)Find an expression for in terms of **a** and **b**

Give your answer in its simplest form.

= ......................................................

**(2)**

(*b*)Use a vector method to show that *MNE* is a straight line.

**(3)**

**(Total for Question 22 is 5 marks)**

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

**23** *G* is the point on the curve with equation *y* = 8*x*2 – 14*x* – 6 where the gradient is 10

The straight line **Q** passes through the point *G* and is perpendicular to the tangent at *G*

Find an equation for **Q**

Give your answer in the form *ax* + *by* + *c* = 0 where *a*, *b* and *c* are integers.

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

**(Total for Question 23 is 5 marks)**

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

**24** An arithmetic sequence has first term 8 and common difference 11

The sequence has *k* terms, where *k* > 21

The sum of the last 20 terms of the sequence is 10 170

Find the value of *k*

Show clear algebraic working.

*k* = ......................................................

**(Total for Question 24 is 5 marks)**

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

**TOTAL FOR PAPER = 100 MARKS**