education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS

COMMON TEST

SEPTEMBER 2019

MARKS: 75

TIME: 1½ hours

This question paper consists of 8 pages and 2 DIAGRAM SHEETS.

Copyright Reserved

INSTRUCTIONS AND INFORMATION

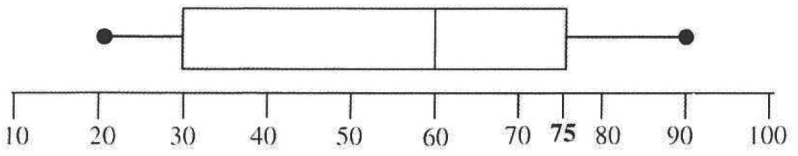
Read the following instructions carefully before answering the questions:

1. This question paper consists of 6 questions.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. TWO DIAGRAM SHEETS for QUESTION 2.2, QUESTION 2.3 AND QUESTION 5.1.1 are attached at the end of this question paper. Detach the DIAGRAM SHEETS and hand in together with your ANSWER BOOK.
10. Write neatly and legibly.

Copyright Reserved

QUESTION 1

1.1 The box and whisker diagram below shows the marks obtained by a class of 19 learners in a mathematics test. The test was out of 100 marks.



1.1.1 Describe the skewness of the data. (1)

1.1.2 Determine the interquartile range of the data. (2)

1.1.3 If the pass requirement for the test is 30% and only one learner obtained 30% in the test, estimate the number of learners in the class who failed the test. (2)

1.2 The table below shows the price in Rands of 1 litre of petrol for each month in 2017.

Months in the year (2017)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Price of 1 litre of petrol (in Rands)	13.09	13.38	13.30	13.08	13.57	13.32	12.63	12.82	13.49	13.74	13.78	14.49

1.2.1 Determine the mean price of petrol in 2017. (2)

1.2.2 Write down the standard deviation of the data. (1)

1.2.3 In how many months during 2017 was the price of 1 litre of petrol outside ONE standard deviation of the mean? (3)
[11]

Copyright Reserved

QUESTION 2

The amount of data, in megabytes, that a student used browsing the internet each day was recorded. The information is given in the frequency table below.

Amount of data used (in megabytes)	Number of days
$100 < d \leq 200$	2
$200 < d \leq 300$	5
$300 < d \leq 400$	11
$400 < d \leq 500$	25
$500 < d \leq 600$	37
$600 < d \leq 700$	21
$700 < d \leq 800$	15
$800 < d \leq 900$	14

2.1 Calculate the estimated mean amount of data used per day. (3)

2.2 Complete the cumulative frequency column in the table provided on DIAGRAM SHEET 1. (2)

2.3 Use the grid provided on DIAGRAM SHEET 1 to draw an ogive (cumulative frequency curve) to represent the data. (4)
[9]

QUESTION 3

3.1 Two bags, A and B, are filled with coloured balls.
It is equally likely that Jade will choose bag A or bag B.
Bag A is filled with 5 green balls (G) and 3 yellow balls (Y).
Bag B is filled with 2 green balls (G) and 6 yellow balls (Y).
Jade randomly selects a bag and draws a ball from it.

3.1.1 Draw a tree diagram to represent the above information. Show the probabilities associated with each branch as well as the possible outcomes. (3)

3.1.2 Write down the probability that Jade will select bag A and draw a green ball from it. (1)

3.1.3 Calculate the probability of Jade choosing a yellow ball. (3)

3.2 A and B are two events in a sample space. P(not A) = 0,48 and P(B) = 0,32.

3.2.1 Determine P(A). (1)

3.2.2 Determine P(A and B) if A and B are independent events. (2)

Copyright Reserved

3.3 During the Olympic Games in 2016, complaints about a certain hotel fell into 3 main categories: Reception (R), Food (F) and Accommodation (A).
A total of 173 complaints were received about this hotel.

There were:
115 complaints about the Reception.
55 complaints about the Food.
63 complaints about the Accommodation
23 complaints about the Reception and the Food but not the Accommodation.
12 complaints about the Reception and the Accommodation but not the Food.
17 complaints about the Food and the Accommodation but not the Reception.

Let the number of complaints about all 3 categories be x.

3.3.1 Draw a Venn Diagram to represent the information above. (3)

3.3.2 Determine the value of x. (2)

3.3.3 Determine the probability that a complaint, selected at random from those received, was about:

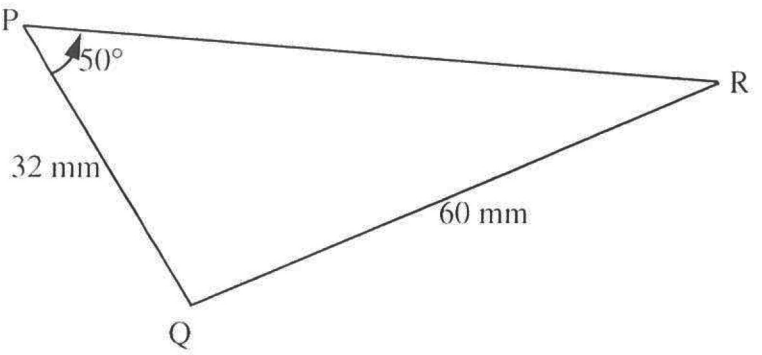
(a) The Accommodation only. (1)

(b) At least two of the categories. (2)
[18]

Copyright Reserved

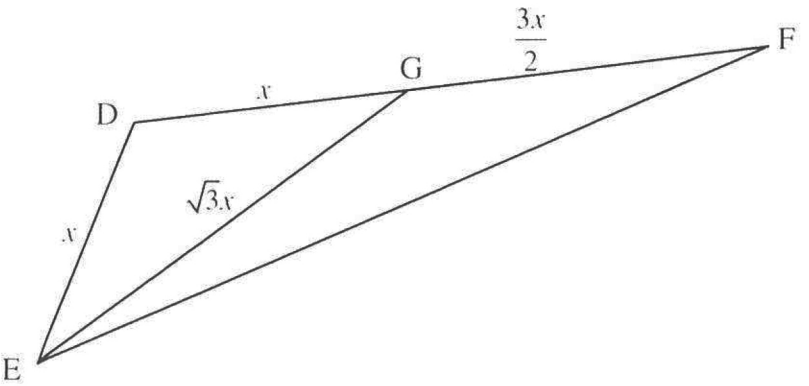
QUESTION 4

4.1 The sketch below shows ΔPQR with PQ = 32 mm, QR = 60 mm and $\hat{P} = 50°$.



Calculate the size of $\hat{R}$. (3)

4.2 ΔDEF is shown in the sketch below. G is a point on DF and EG is drawn.
DG = DE = x. FG = $\frac{3x}{2}$ and EG = $\sqrt{3}x$.



4.2.1 Calculate the size of $\hat{D}$. (4)

4.2.2 Calculate the area of ΔGEF in terms of x, in its simplest form. (5)

[12]

QUESTION 5

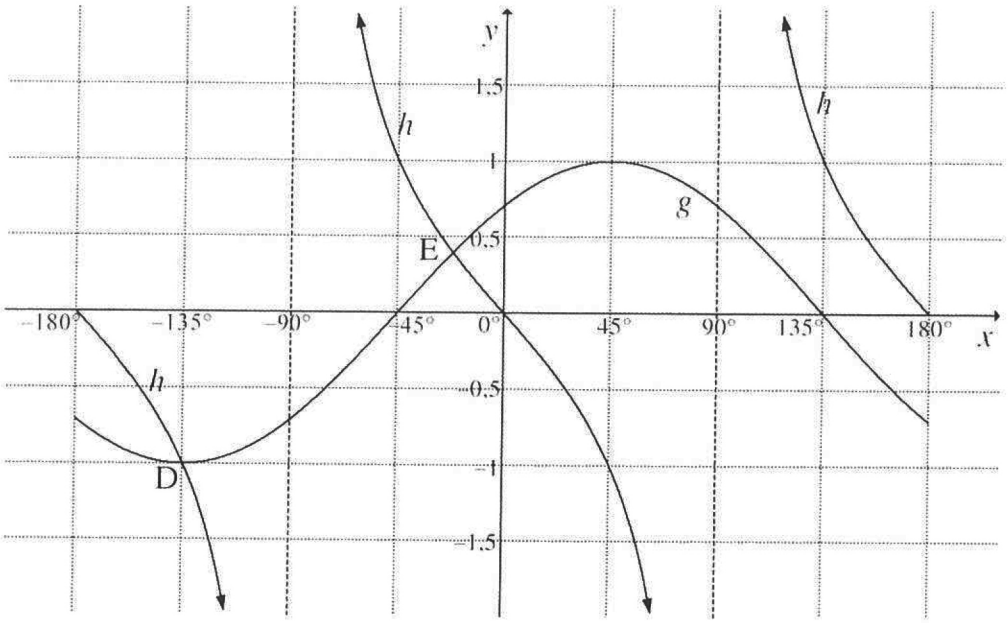
5.1 Given $f(x) = 2\cos 3x$.

5.1.1 Use the grid on DIAGRAM SHEET 2 and draw a sketch graph of f for the interval $x \in [-90° ; 90°]$. Clearly show all intercepts with the axes and turning points of the graph. (3)

5.1.2 Write down the period of f. (1)

5.1.3 Write down the range of f. (1)

5.2 In the diagram below the graphs of $g(x) = \sin(x + a)$ and $h(x) = b\tan cx$ are drawn in the interval $x \in [-180° ; 180°]$. g and h intersect at D and E. The coordinates of D are $(-135° ; -1)$ and the coordinates of E are approximately $(-22{,}3° ; 0{,}4)$.



5.2.1 Write down the values of a, b and c. (3)

5.2.2 Write down the equations of the asymptotes of h in the interval $[-180° ; 180°]$. (2)

5.2.3 Solve for x if $g(x) - h(x) \geq 0$ in the interval $[-180° ; 0°]$. (4)

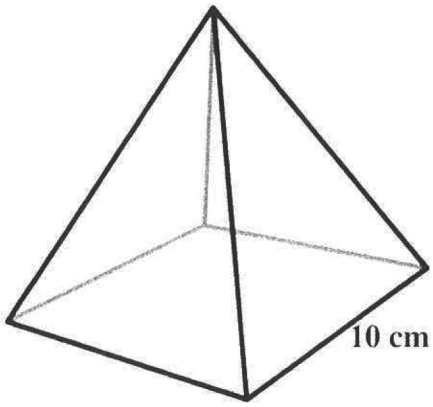
5.2.4 Describe the transformation of g to m if $m(x) = \cos x - 1$. (2)

[16]

Copyright Reserved

QUESTION 6

6.1 The sketch below shows a pyramid on a square base.
The length of a side of the base is 10 cm and the perpendicular height of the pyramid is 15 cm.



Volume of pyramid $= \frac{1}{3} \times$ area of base $\times$ perpendicular height
Total surface area of pyramid = area of base + sum of areas of the triangular faces

6.1.1 Calculate the volume of the pyramid. (2)

6.1.2 Calculate the total surface area of the pyramid. (4)

6.2 A child is given some modelling clay to play with. At first, he uses all the clay to make a single sphere (ball).

Thereafter, he uses all the clay to make identical smaller spheres. If the diameter of each of the smaller spheres is exactly half the diameter of the original sphere, how many smaller spheres will he be able to make?

Volume of sphere $= \frac{4}{3}\pi r^3$
Total surface area of sphere $= 4\pi r^2$

(3)
[9]

TOTAL MARKS: 75

Copyright Reserved

NAME & SURNAME:

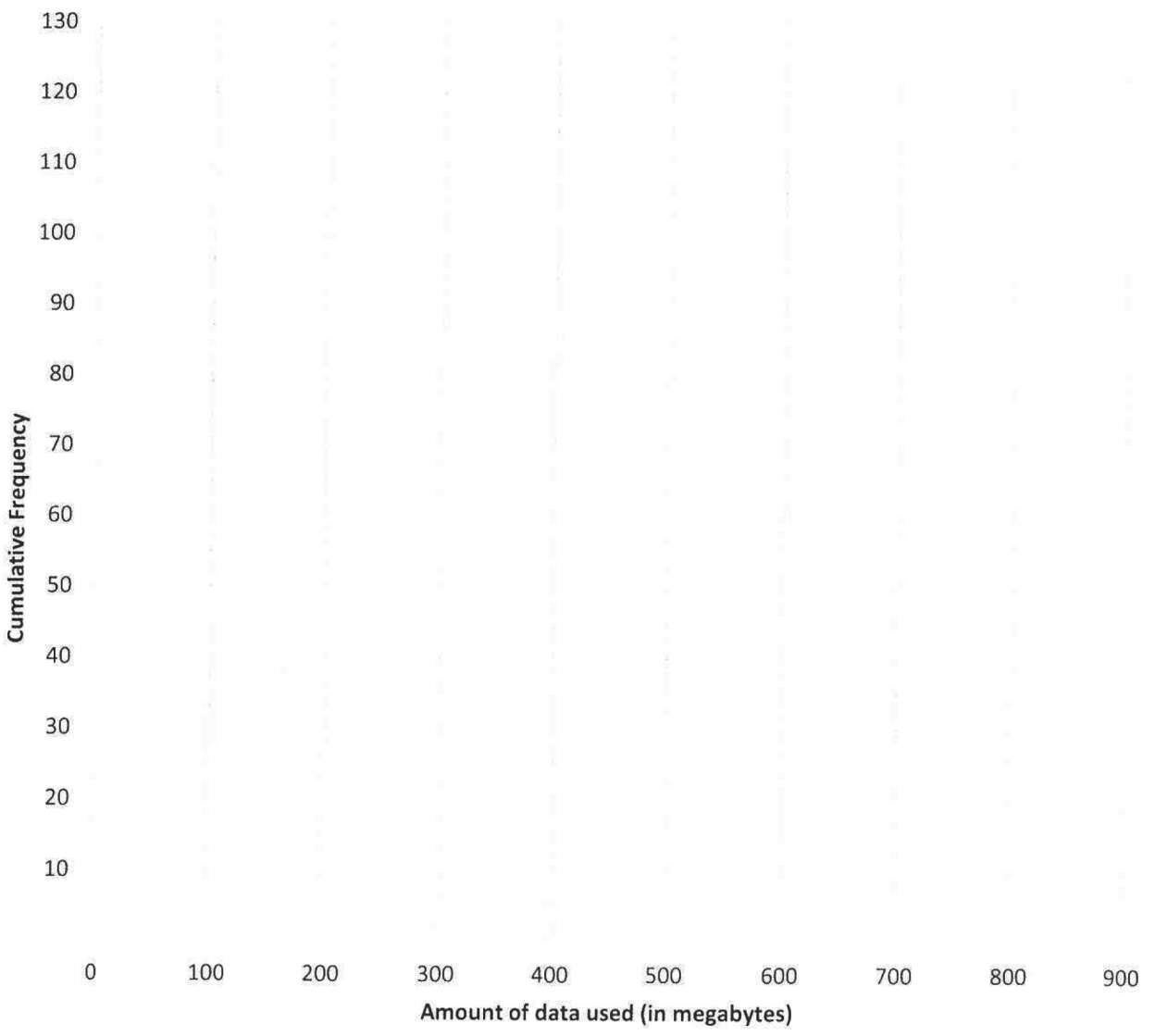
DIAGRAM SHEET 1

QUESTION 2.2

Amount of data used (in megabytes)	Number of days	Cumulative frequency
$100 < d \leq 200$	2	
$200 < d \leq 300$	5	
$300 < d \leq 400$	11	
$400 < d \leq 500$	25	
$500 < d \leq 600$	37	
$600 < d \leq 700$	21	
$700 < d \leq 800$	15	
$800 < d \leq 900$	14	

UESTION 2.3

TEAR OFF

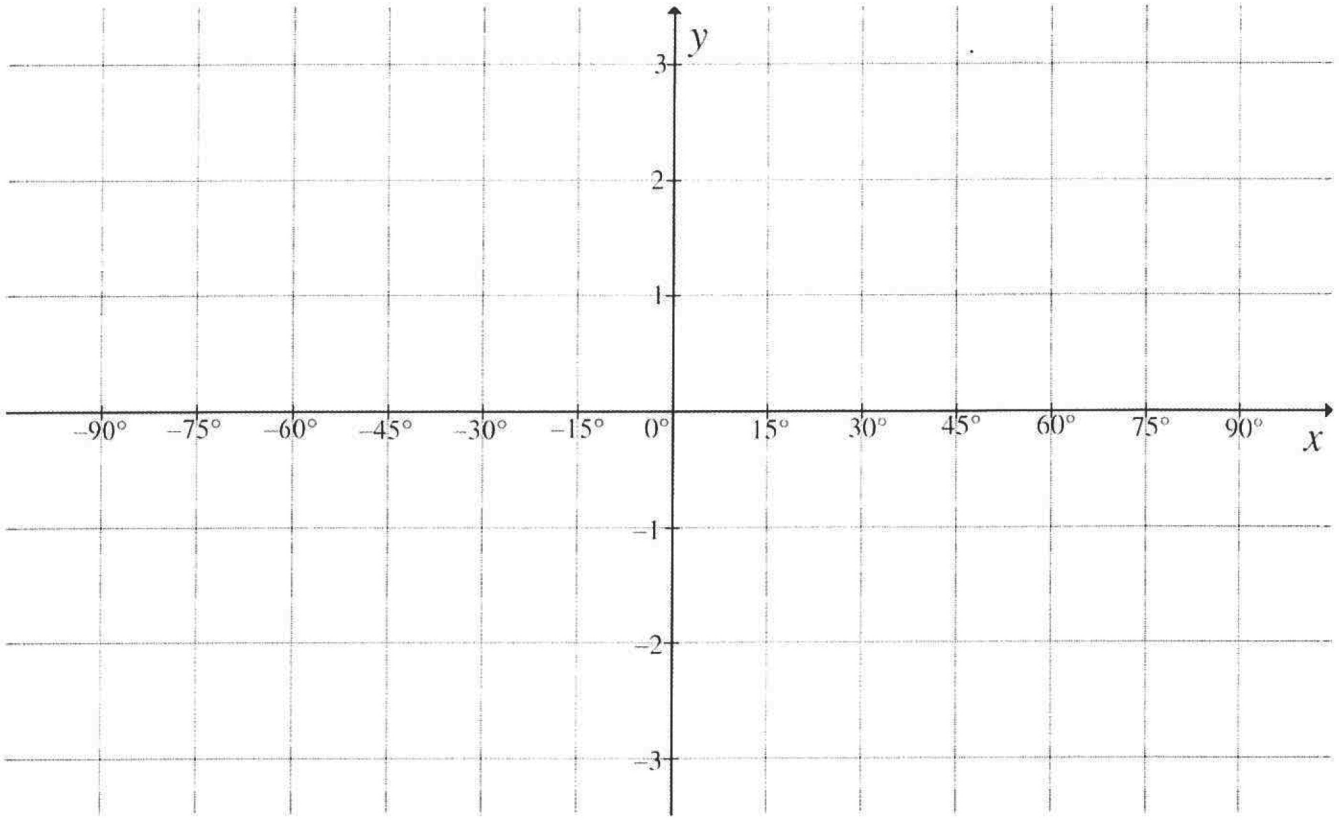


Copyright Reserved

NAME & SURNAME:

DIAGRAM SHEET 2

QUESTION 5.1.1



TEAR OFF

Copyright Reserved

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL
SENIOR CERTIFICATE

GRADE 11

MATHEMATICS

COMMON TEST

SEPTEMBER 2019

MARKING GUIDELINE

MARKS: 75

This marking guideline consists of 8 pages.

Copyright Reserved

QUESTION 1

1.1.1	Data is skewed to the left or negatively skewed	✓ answer (1)
1.1.2	IQR = 75 -30 = 45 Answer only: Full marks	✓ both quartiles ✓ answer (2)
1.1.3	30 marks is at position $\frac{1}{4}(19+1)$ =5 ∴4 failed the test Answer only: Full marks	✓ position 5 ✓ answer (2)
1.2.1	$\bar{x} = \frac{160,69}{12}$ = R13,39 Answer only: Full marks	✓ 160,69 ✓ answer (2)
1.2.2	σ = R0,47	✓ answer (1)
1.2.3	(13,39 – 0,47 ; 13,39 + 0,47) = (12,92 ; 13,86) ∴3 months	✓✓ interval ✓ answer (3)
		[11]

Copyright Reserved

QUESTION 2

2.1

$$\frac{(150\times 2)+(250\times 5)+(350\times 11)+(450\times 25)+(550\times 37)+(650\times 21)+(750\times 15)+(850\times 14)}{130}$$

$\bar{x} \approx \frac{73800}{130}$

= 567,69 megabytes

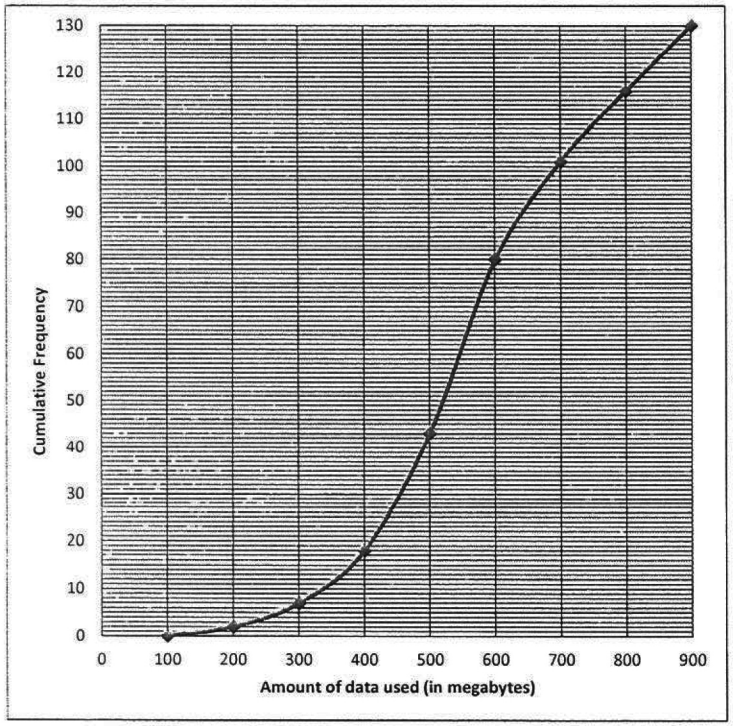
✓ 73800
✓ 130
✓ answer
(3)

2.2

Amount of data used (in megabytes)	Number of days	Cumulative frequency
$100< d \leq 200$	2	2
$200< d \leq 300$	5	7
$300< d \leq 400$	11	18
$400< d \leq 500$	25	43
$500< d \leq 600$	37	80
$600< d \leq 700$	21	101
$700< d \leq 800$	15	116
$800< d \leq 900$	14	130

✓ 2, 7, 18, 43
✓ 80, 101, 116, 130
(2)

2.3

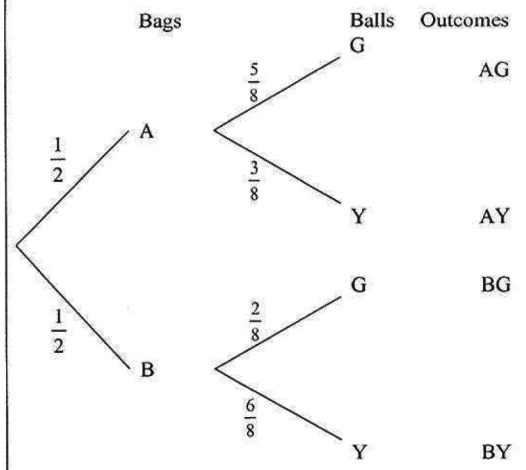


✓ grounded at (100 ; 0)
✓ upper limits
✓ cum f
✓ shape: smooth curve

[9]

QUESTION 3

3.1.1



✓ branches
✓ probabilities on branches
✓ outcomes
(3)

3.1.2

P(green ball from bag A) = $\frac{1}{2}\times\frac{5}{8}$

= $\frac{5}{16}$ **OR** 0,31

✓ answer
(1)

3.1.3

P(yellow ball) = $\left(\frac{1}{2}\times\frac{3}{8}\right)+\left(\frac{1}{2}\times\frac{6}{8}\right)$

= $\frac{9}{16}$ **OR** 0,56

✓ $\left(\frac{1}{2}\times\frac{3}{8}\right)$ ✓ $\left(\frac{1}{2}\times\frac{6}{8}\right)$
✓ answer
(3)

3.2.1

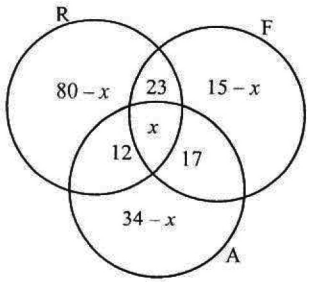
P(A) = 1 – 0,48
= 0,52

✓ answer
(1)

3.2.2

P(A and B) = P(A) × P(B)
= 0,52 × 0,32
= 0,17 **OR** $\frac{104}{625}$

✓ correct substitution into formula
✓ answer
(2)

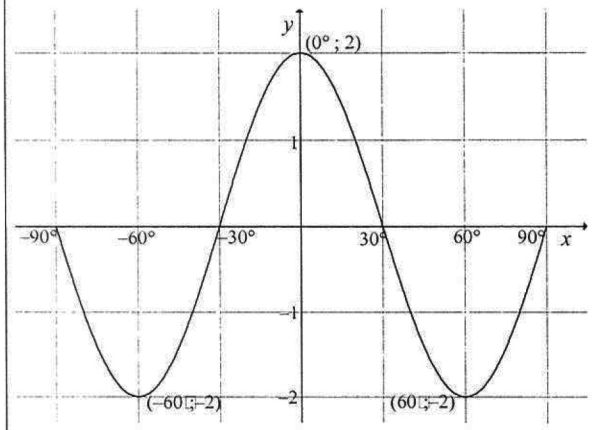
3.3.1		✓ 80 – x , 23 ✓ 15 – x , 17 ✓ 34 – x , 12 (3)
3.3.2	$80-x+23+15-x+12+x+17+34-x=173$ $181-2x=173$ $x=4$	✓ sum of values in Venn diagram = 173 ✓ answer (2)
3.3.3(a)	P(A only) = $\frac{30}{173}$	✓ answer (1)
3.3.3(b)	P(at least two categories) = $\frac{23+12+4+17}{173}$ = $\frac{56}{173}$ **OR** 0,32	✓ 23 + 12 + 4 + 17 = 56 ✓ answer (2)
		[18]

QUESTION 4

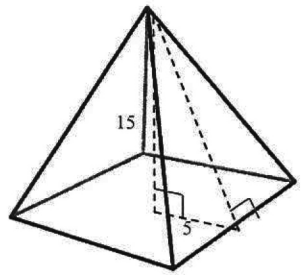
4.1	$\frac{\sin\hat{R}}{r}=\frac{\sin\hat{P}}{p}$ $\frac{\sin\hat{R}}{32}=\frac{\sin 50°}{60}$ $\sin\hat{R}=\frac{\sin 50°\times 32}{60}$ $\hat{R}=24{,}11°$	✓ applying sine rule in ΔPQR ✓ $\sin\hat{R}$ the subject of the formula ✓ answer (3)

4.2.1	$EG^2=DE^2+DG^2-2.DE.DG.\cos\hat{D}$ $(\sqrt{3}x)^2=x^2+x^2-2.x.x.\cos\hat{D}$ $3x^2=2x^2-2x^2\cos\hat{D}$ $x^2+2x^2\cos\hat{D}=0$ **OR** $2x^2\cos\hat{D}=-x^2$ $x^2(1+2\cos\hat{D})=0$ $\cos\hat{D}=\frac{-x^2}{2x^2}$ $\cos\hat{D}=-\frac{1}{2}$ $\hat{D}=120°$	✓ applying cosine rule in ΔDEG ✓ simplification ✓ value of $\cos\hat{D}$ ✓ answer (4)
4.2.2	$D\hat{G}E=\frac{180°-120°}{2}$ [sum of ∠s of isosceles Δ] $=30°$ $E\hat{G}F=180°-30°$ [∠s on a straight line] $=150°$ Area of $\Delta GEF=\frac{1}{2}(GE)(GF)(\sin E\hat{G}F)$ $=\frac{1}{2}(\sqrt{3}x)(\frac{3x}{2})(\sin 150°)$ $=\frac{1}{2}(\sqrt{3}x)(\frac{3x}{2})(\frac{1}{2})$ $=\frac{3\sqrt{3}}{8}x^2$ **OR** Area of ΔGEF = Area of ΔEDF – Area of ΔEDG $=\frac{1}{2}(x)(\frac{5}{2}x)(\sin 120°)-\frac{1}{2}(x)(x)(\sin 120°)$ $=\frac{5}{4}x^2(\frac{\sqrt{3}}{2})-\frac{1}{2}x^2(\frac{\sqrt{3}}{2})$ $=\frac{3}{4}(\frac{\sqrt{3}}{2})x^2$ $=\frac{3\sqrt{3}}{8}x^2$	✓ size of $D\hat{G}E$ ✓ size of $E\hat{G}F$ ✓ applying area rule in ΔEGF ✓ substitution ✓ answer (5) ✓ Area of ΔEDF – Area of ΔEDG ✓ applying area rule in ΔEDF ✓ applying area rule in ΔEDG ✓ substitution ✓ answer (5)
		[12]

QUESTION 5

5.1.1		✓ x – intercepts ✓ y – intercept ✓ turning points (3)
5.1.2	120°	✓ answer (1)
5.1.3	$y \in [-2\,;\,2]$	✓ answer (1)
5.2.1	$a = 45°$ $b = -1$ $c = 1$	✓ $a = 45°$ ✓ $b = -1$ ✓ $c = 1$ (3)
5.2.2	$x = -90°$ $x = 90°$	✓ $x = -90°$ ✓ $x = 90°$ (2)
5.2.3	$-135° \le x < -90°$ or $-22{,}3° \le x \le 0°$	✓✓ $-135° \le x < -90°$ ✓✓ $-22{,}3° \le x \le 0°$ (4)
5.2.4	Shift the graph of g 45° to the left and 1 unit downwards	✓ shift 45° to the left ✓ shift 1 unit downwards (2)
		[16]

QUESTION 6

6.1.1	$V = \frac{1}{3} \times \text{area of base} \times \text{height}$ $= \frac{1}{3} \times 10^2 \times 15$ $= 500 \text{ cm}^3$	✓ substitution ✓ answer (2)
6.1.2	 Slant height $= \sqrt{5^2 + 15^2} = \sqrt{250} = 5\sqrt{10}$ TSA of pyramid $=$ area of base $+ 4$(area of a triangle) $= 100 + 4\left(\frac{1}{2} \times 10 \times 5\sqrt{10}\right)$ $= 416{,}23 \text{ cm}^2$	✓ $\sqrt{5^2 + 15^2}$ or $\sqrt{250}$ **OR** $5\sqrt{10}$ ✓ substitution into correct formula ✓ $\frac{1}{2} \times 10 \times 5\sqrt{10}$ ✓ answer (4)
6.3	Let $r_{\text{single sphere}} = r$ and $r_{\text{smaller sphere}} = \frac{1}{2}r$. Then: $V_{\text{single sphere}} = \frac{4}{3}\pi r^3$ And: $V_{\text{smaller sphere}} = \frac{4}{3}\pi\left(\frac{1}{2}r\right)^3$ $= \frac{4}{3}\pi\left(\frac{1}{8}r^3\right)$ $= \frac{1}{8}\left(\frac{4}{3}\pi r^3\right)$ Therefore 8 smaller spheres can be made using the same modelling clay. **OR** The radius of a smaller sphere is 2 times smaller than radius of the single sphere. Because the volume of a sphere depends on r^3, the volume of the smaller sphere will be $2^3 = 8$ times smaller than the volume of the single sphere. Therefore 8 smaller spheres can be made from the modelling clay.	✓ $\frac{4}{3}\pi\left(\frac{1}{2}r\right)^3$ ✓ $\frac{1}{8}\left(\frac{4}{3}\pi r^3\right)$ ✓ answer (3) **OR** ✓ r = 2 times smaller ✓ V = 2^3 times smaller ✓ answer (3)

TOTAL : 75