

Paper 2 June 2019

1) $y = x^2 - 4x + 1$

all the given points have
x coordinate -1

$$f(x) = x^2 - 4x + 1$$

$$f(-1) = (-1)^2 - 4(-1) + 1$$

$$= 1 + 4 + 1$$

$$= 6$$

so $(-1, 6)$ lies on the curve.

2) The answer that the
examiner wants the student
to give is

$$11.5 \leq \text{height} < 12.5$$

This is actually the wrong
answer but for now let's
just give the examiner what
he wants to see.

Ask your tutor to explain fully.

3) $2a = 5b$

$$a : b$$

$$5 : 2$$

The rule of thumb is just to
reverse the numbers.

4) The two Venn symbols are

$\cup$ union which roughly translates
as A OR B OR BOTH

$\cap$ intersection which roughly
translates as A AND ALSO B.

Because our terms "and" and
"or" in normal English are
a bit ill-defined we specifically
introduced the terms
UNION and INTERSECTION
which are unambiguous as
to their precise meaning.

The shaded region is $A \cap B$

5) A construction question

a) Construct circle centre A radius
4cm. strictly dotted

b) Construct perpendicular bisector of BC
strictly dotted.

6) Beth drives 200 miles in 4 hours
18 miles at 36 mph

$$\text{Speed} = \text{distance} / \text{time}$$

$$\text{time} = \text{distance} / \text{speed}$$

$$= 18 / 36 = \frac{1}{2} \text{ hour}$$

Time remaining therefore $3\frac{1}{2}$ hr.

$$\text{Distance remaining} = 182 \text{ miles}$$

$$\text{Average Speed} = \frac{182}{3\frac{1}{2}} = 52 \text{ mph}$$

7)

$$AB^2 = 17^2 - 8^2 = 225$$

$$AB = 15$$

This is a pythagorean triangle

$$BC : CD$$

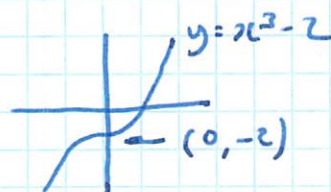
Total

$$\times 8 \left(\begin{array}{l} 1 : 2 \\ 8 : 16 \end{array} \right) \times 8$$

24

$$\text{so area is } 15 \times 24 = 360 \text{ cm}^2$$

8)



The function $y = x^3$ is an odd
function with rotational symmetry
and $y = x^3 - 2$ moves the graph
down by two units.

9) The data given is continuous
grouped.

b) the median is $\frac{380}{2} = 190$

$$\text{and lies in group } 2 < t \leq 4$$

c) % more than 6 minutes

$$= \frac{45 + 12}{380} \times 100$$

$$= 15\%$$

$$10) -4 < x \leq 2 \quad (1)$$

$$2 \leq x+3 < 9 \quad (2)$$

$$(2) \Rightarrow 2-3 \leq x < 9-3$$

$$\Rightarrow -1 \leq x < 6$$

From (1) $x \Rightarrow -3, -2, -1, 0, 1, 2$

From (2) $x \Rightarrow -1, 0, 1, 2, 3, 4, 5$

So combining the two x can be

$$-1, 0, 1, 2$$

$$-1 \leq x \leq 2$$

11) Joe : Kyle Total

$$x5 \left(\begin{array}{l} 7 : n \\ 35\% : 65\% \end{array} \right) \times 5 \quad \begin{array}{l} 7+n \\ 100\% \end{array}$$

$$\text{so } n = 13$$

12) Best estimate $P(\text{Heads}) = 0.3$

The careless student will write the value under 50 - 0.4.

But for the best estimate we take the highest frequency.

	MP	No	Product
$0 \leq x < 20$	10	22	220
$20 \leq x < 40$	30	9	270
$40 \leq x < 60$	50	6	300
$60 \leq x < 80$	70	3	210
	<u>40</u>		<u>1000</u>

$$\frac{1000}{40} = £25$$

$$\begin{array}{l} \text{Boys : Girls} \\ 25 \quad 35 \end{array}$$

$$25 \times x = 35$$

$$x = \frac{35}{25}$$

$$= 1.4$$

$$\frac{\% \text{ mean girls}}{\% \text{ mean boys}} = 140\%$$

14) 3 digit code

Ali uses 1 3 5 7 9

Mel uses 2 4 6 8

Ali can construct $5 \times 4 \times 3 = 60$

Mel can construct $4 \times 3 \times 2 = 24$

$$x = 60 - 24 = 36$$

15) if digits can be repeated

Ali can construct $5 \times 5 \times 5 = 125$

Mel can construct $4 \times 4 \times 4 = 64$

$$x = 125 - 64 = 61$$

so x is bigger.

16)

Line has equation $y = x - 1$

$$\text{if } x = 0 \quad y = -1$$

$$\text{if } y = 0 \quad x = 1$$

and that gives us the scales for the coordinates x and y .
(see diagram on paper)

and now we have to points for L

$$(0, 3) \quad \text{and} \quad (2, 0)$$

$$x_1, y_1 \quad x_2, y_2$$

Now we use relationship

$$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$$

and careful substitution of all the values we get

$$\frac{y - 3}{0 - 3} = \frac{x - 0}{2 - 0}$$

$$\frac{y - 3}{-3} = \frac{x}{2}$$

$$2y - 6 = -3x$$

$$2y = -3x + 6$$

$$y = -\frac{3}{2}x + 3$$

and we can check this is correct by looking at coordinate intercepts.

$$x = 0 \quad y = 3 \quad y = 0 \quad x = 2$$

✓
checked

16) ABC and ACD triangles

$$\text{In ACD Area} = \frac{1}{2} h \times 14$$

$$\frac{1}{2} h \times 14 = 80\frac{1}{2}$$

$$h = \frac{2 \times 80\frac{1}{2}}{14} = 11\frac{1}{2}$$

for Area ABC we use formula

$$\frac{1}{2} ab \sin C$$

$$= \frac{1}{2} 19 \times 11\frac{1}{2} \times \sin 36^\circ$$

$$= 64.2 \text{ cm}^2 \text{ to 3 sig fig.}$$

17) $m = \frac{p-2b}{2}$

$$p = 68.3 \text{ to 1 dp}$$

$$b = 8.7 \text{ to 1 dp}$$

so the lower bound for m is

$$\frac{68.25 - 2 \times 8.75}{2} = 25.375$$

18) discs blue green and white

$$\begin{matrix} & 4 & : & 1 & : & ? \\ \times 3 \left(\begin{matrix} \swarrow & & \searrow \\ 3 & : & ? & : & 5 \end{matrix} \right) \times 3 \\ & 12 & : & 3 & : & 20 \end{matrix}$$

$$P(\text{blue or white}) = \frac{32}{35}$$

19) Height trapezium given by

$$\tan 64^\circ = \frac{h}{4}$$

$$h = 4 \tan 64^\circ$$

$$\text{so area} = \frac{1}{2} (11+15) \times 4 \tan 64^\circ$$

$$= 106 \text{ cm}^2 \text{ (3 sig fig)}$$

20) $\frac{n(n+1)}{2} + \frac{(n+1)(n+2)}{2}$

$$= \left(\frac{n+1}{2}\right)(n+n+2)$$

$$= \left(\frac{n+1}{2}\right) 2(n+1)$$

$$= (n+1)^2$$

Example $6+10 = 16$

21) total surface area

$$(\pi r l)_{\text{small}} + (\pi r l)_{\text{large}}$$

$$\Rightarrow \pi r 2r + \pi r 3r = 57.8\pi$$

$$2r^2 + 3r^2 = 57.8$$

$$5r^2 = 57.8$$

$$r^2 = 11.56$$

$$r = 3.4$$

and we discount the negative root.

22) $(5\sqrt{3} - \sqrt{12})^2$

$$= (5\sqrt{3} - \sqrt{4 \times 3})^2$$

$$= (5\sqrt{3} - 2\sqrt{3})^2$$

$$= (3\sqrt{3})^2$$

$$= 3^3 = 27$$

and if we enter into the calculator as a check we get 27.

23) A : B

$$\text{surface area } 16 : 25$$

$$\text{length } 4 : 5$$

$$\text{volume } 4^3 : 5^3$$

$$64 : 125$$

which is an option given.

24)

$$y = x^2 + 4x - 12$$

factorise

$$y = (x+6)(x-2)$$

so the x intercepts are -6 and +2

$$\text{so } x^2 + 4x - 12 < 0$$

$$\text{when } -6 < x < +2$$

This is an easy 3 marks if you understand the theory of quadratics

25) Sample 50 eggs

Mass	Freq.	
$53 < m \leq 58$	8	farm A.
$58 < m \leq 63$	19	
$63 < m \leq 68$	15	
$68 < m \leq 73$	8	

medium eggs $53g < \text{mass} \leq 63g$

farm A has 27 eggs in this range

farm B has area between 53 and 63.

$$\Rightarrow 2 \times 1 + 8 \times 2 = 18$$

$$\text{Estimate } 27 - 18 = 9 \text{ eggs} \quad \checkmark$$

26)

$$(x+5)(x+2)(x+a) = x^3 + bx^2 + cx - 30$$

Now we can immediately calculate a by equating x^0 terms

$$5 \times 2 \times a = -30 \text{ so } a = -3$$

and now we expand

$$\begin{aligned} & (x+5)(x+2)(x-3) \\ &= (x^2 + 7x + 10)(x-3) \\ &= x^3 + 7x^2 + 10x - 3x^2 - 21x - 30 \\ & \quad \underline{-3x^2 - 21x - 30} \\ & \quad x^3 + 4x^2 - 11x - 30 \end{aligned}$$

$$\text{so } b = 4 \quad c = -11 \quad a = -3 \quad \checkmark \checkmark$$

$$27) \quad f(x) = \frac{2x}{5} - 1$$

$$\text{let } y = \frac{2x}{5} - 1$$

$$y+1 = \frac{2x}{5}$$

$$x = \frac{5}{2}(y+1)$$

$$f^{-1}(x) = \frac{5}{2}(x+1)$$

$$f^{-1}(3) = \frac{5}{2}(3+1)$$

$$f^{-1}(3) = 5$$

$$f^{-1}(3) + f(0.5) = 5 + 3 = 8 \quad \checkmark$$

ROBERT GOODHAND