

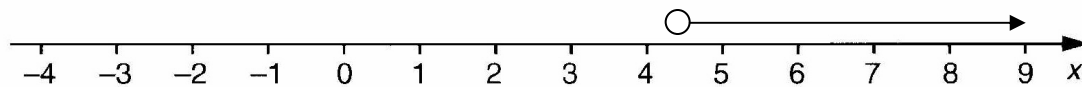
**OCR 1962**  
**Summer 2004**  
**HIGHER SOLUTIONS**  
**Paper 5 (Non-calculator)**

1.

(a)  $12x + 3 + 4x - 2 \rightarrow 16x + 1$

(b)(i)  $2x \geq 9 \rightarrow x \geq 4 \frac{1}{2}$

(ii) See number line



2.

(a) To work out how many sides the polygon has, you just divide 360 by the

exterior angle  $\rightarrow \frac{360}{30} = 12$  sides

(b) As you can see from the diagram, you are able to use Pythagoras to work out

the length of AB  $\rightarrow h^2 = a^2 + b^2 \rightarrow h^2 = (5)^2 + (12)^2 \rightarrow h^2 = 25 + 144 \rightarrow h^2 = 169$

$\rightarrow h = \sqrt{169} \rightarrow h = \pm 13$  but AB can only be +13 as it is a length

3.

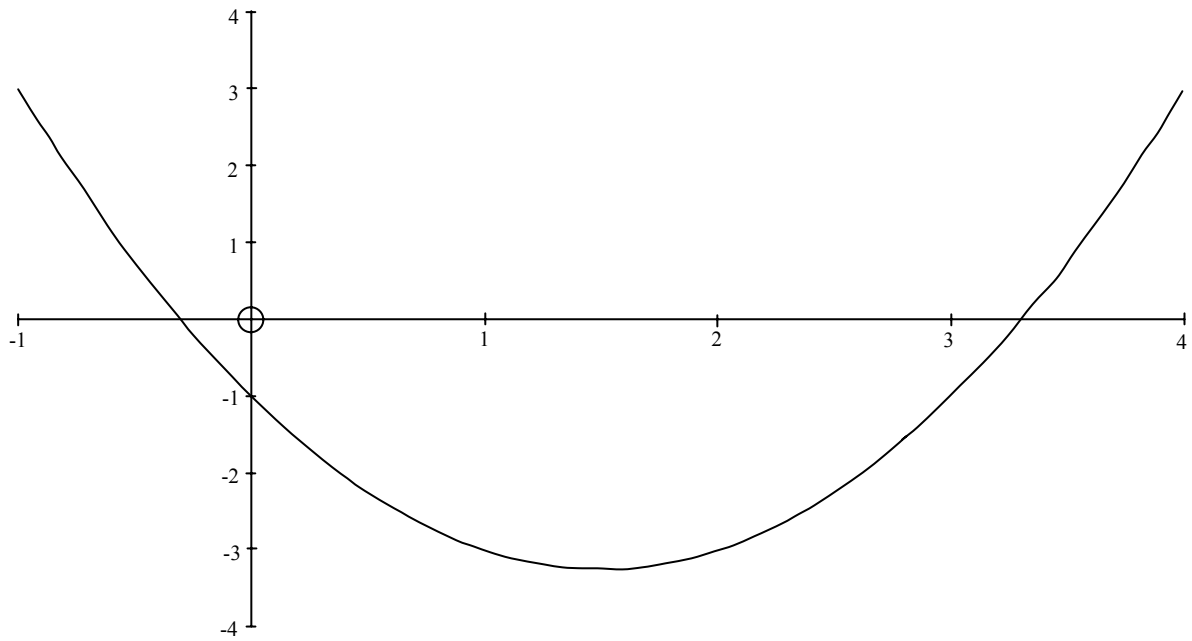
(a)

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

(b) See graph

(c) What this means is where does the curve  $y = x^2 - 3x - 1$  intersect with the line  $y = 0$  (which is the  $x$  axis)

$\rightarrow$  About -0.3 and 3.3



4.

(a) Anne's results are most likely to be accurate as her sample size is the largest

(b)(i)  $\frac{40}{200} \rightarrow \frac{1}{5}$

(ii) No. of students  $\times$  Probability  $\rightarrow 1200 \times \frac{1}{5} = 240$  students

(c) What this is saying is, 'what is the probability person 1 is left handed AND person 2 is left handed?'. Remember when talking about probability AND means

multiply while OR means add  $\rightarrow \frac{1}{5} \times \frac{1}{5} = \frac{1}{25}$

5.

(a)  $\sqrt{\frac{300^2}{900}} \rightarrow \sqrt{\frac{90000}{900}}$  cancel 2 noughts from the top with 2 on the bottom

$\rightarrow \sqrt{\frac{900}{9}} \rightarrow \sqrt{100} \rightarrow \pm 10$

(b) If the crates are to the nearest tonne then the maximum weight they could be

is  $6 \frac{1}{2}$  tonnes  $\rightarrow 6 \frac{1}{2} \times 7$  crates =  $45 \frac{1}{2}$  tonnes

45.5 tonnes > 44 tonnes, therefore this load is *not* legal

6.

(a)(i) Which 2 numbers multiply to make 24 and add/subtract to make 10?  $\rightarrow$  6 and 4

$$\rightarrow (x+6)(x+4)$$

(ii)  $(x+6)(x+4) = 0 \rightarrow$  Either  $x+6=0$ , hence  $x=-6$  or  $x+4=0$ , hence

$$x = -4$$

(b) We need to get rid of the square root, this can be achieved by squaring both

$$\text{sides} \rightarrow P^2 = 6T \rightarrow T = \frac{P^2}{6}$$

7.

What do we know from looking at the diagram? OQ and OP are radii and therefore

OQP is an isosceles triangle. PT meets OP at  $90^\circ$ ,

(The angle between the tangent and the radius is  $90^\circ$ ). Angle QOP must be  $180 - 70 = 110^\circ$

as angles on a straight line add up to  $180^\circ$ . This means that OPQ must equal  $\frac{180-110}{2} = 35^\circ$ .

Hence angle  $x^\circ$  will be  $90 - 35 = 55^\circ$

8.

(a) Look at the ratio of the heights and diameters

10cm : 15cm Diameters

16cm :  $x$  Heights

How do you get from 10 to 15? By multiplying by  $\frac{3}{2}$ . Apply this to 16 to work out

$$x \rightarrow 16 \times \frac{3}{2} \rightarrow \frac{48}{2} = 24\text{cm}$$

(b) Look at the ratios like you did in part (a)

8cm : 12cm Width

$d$  : 18cm Height

How do you get from 12 to 8? By multiplying by  $\frac{2}{3}$ . Apply this to 18 to work out

$$d \rightarrow 18 \times \frac{2}{3} \rightarrow \frac{36}{3} \rightarrow 12\text{cm}$$

(c) If the diameters of the tins are in the ratio 10 : 15 (2 : 3) then the masses will be

in the ratio  $2^3 : 3^3 \rightarrow 8 : 27$ , compare the ratios now

$$8 : 27$$

$$1000 : y$$

How do you get from 8 to 27? By multiplying by  $\frac{27}{8}$ . Apply this to 1000 to find  $y$

$$\rightarrow 1000 \times \frac{27}{8} \rightarrow \frac{27000}{8} = 3375\text{g}$$

9.

(a) Multiplication on the top so add the indices  $\rightarrow \frac{5^{7+2}}{5^3} \rightarrow \frac{5^9}{5^3}$ . Now it's divide

so subtract the indices  $\rightarrow 5^6$

(b)(i) What is  $10^5$ ?  $\rightarrow 100000$ , what you are really doing is moving the *d.p.* 5 places to the right and adding some extra noughts

$\rightarrow 104000$

(ii)  $7.9 \times 10^{-5} \rightarrow$  Remember in this one the *d.p.* has had to move back 5 places

(iii) Using the fact that  $a^m \times a^n = a^{m+n} \rightarrow 10^6 \times 10^{-3} = 10^3$  and  $8 \times 5 = 40$

$\rightarrow 40 \times 10^3 \rightarrow 40 \times 1000 = 40000$

(c)(i)  $8\sqrt{2}$

(ii)  $\sqrt{8 \times 2} \rightarrow \sqrt{16} \rightarrow \pm 4$

(iii)  $\sqrt{8}$  can also be written as  $\sqrt{4 \times 2} \rightarrow 4$  could be taken out and therefore

squarerooted  $\rightarrow 2\sqrt{2}$ , hence  $\frac{2\sqrt{2}}{\sqrt{2}}$  the  $\sqrt{2}$  cancels with the other leaving 2.

10.

(a)(i) This matches to graph C, as  $y$  increases  $x$  increases

(ii) This matches to graph B, as  $y$  increases  $x^2$  increases

(Think about what  $y = x^2$  looks like)

(iii) This matches with graph E, as  $y$  increases  $x$  decreases

(b)(i) Be careful here, what this is saying is if the value of  $x$  is multiplied by 4 then so is the value of  $y \rightarrow 10 \times 4 = 40$

(ii) Here  $y$  is multiplied by  $4^2 \rightarrow 160$

(iii) Here  $y$  is multiplied by  $\frac{1}{4} \rightarrow 2.5$

11.

(a) P(Purple AND purple)  $\rightarrow \frac{16}{30} \times \frac{15}{29} = \frac{240}{870}$

(b) P(Purple AND purple)  $\rightarrow \frac{11}{15} \times \frac{10}{14} = \frac{110}{210}$

(c) The combinations we do not require are both boys or both girls, so we could do

$1 - \text{these events} \rightarrow 1 - \left( \frac{4}{14} \times \frac{3}{13} + \frac{10}{14} \times \frac{9}{13} \right)$

$\rightarrow \frac{80}{182}$

12.

(a) The area of a rectangle is length  $\times$  width  $\rightarrow l \times x = 50 \rightarrow l = \frac{50}{x}$

hence the perimeter will equal  $x + x + \frac{50}{x} + \frac{50}{x} \rightarrow 2x + \frac{100}{x}$

(b) We have an expression for the perimeter and now we know it equals 33cm.

$\rightarrow 2x + \frac{100}{x} = 33$ , rearrange this into the form  $ax^2 + bx + c = 0$

$\rightarrow 2x - 33 + \frac{100}{x} = 0$ , and now to get to the equation shown, just multiply throughout by  $x$

$\rightarrow 2x^2 - 33x + 100 = 0$

(c) Which two numbers multiply together to make 200 and add / subtract to make  $-33$ ?

$\rightarrow -25$  and  $-8$ , now we can write the equation as,  $2x^2 - 25x - 8x + 100 = 0$ , look at the equation

in two parts,  $2x^2 - 25x = x(2x - 25)$  and  $-4(2x - 25)$ , since we have a common bracket,

$(2x - 25)(x - 4) = 0 \rightarrow$  The dimensions will be  $x = 4$  (*width*) and  $l = 12.5$  (*length*)

13.

(a)  $\sqrt{900} = \pm 30$

(b)  $(\sqrt{6} + \sqrt{15})(\sqrt{6} + \sqrt{15}) \rightarrow \sqrt{36} + 2\sqrt{15 \times 6} + \sqrt{225} \rightarrow 6 + 2\sqrt{90} + 15$

$\rightarrow 21 + 2\sqrt{9 \times 10} \rightarrow 21 + 2 \times 3\sqrt{10} \rightarrow 21 + 6\sqrt{10}$ , hence  $a = 21$  and  $b = 6$

14.

(a) Since the equation is in the form,  $ax^2 + bx + c = 0$ , the completed square will be.

$\left(x + \frac{b}{2}\right)^2 + d$ , All you need to do is work out  $d \rightarrow x^2 + 2x + 5 = (x + 1)^2 + d$

$\rightarrow x^2 + 2x + 5 = x^2 + 2x + 1 + d \rightarrow d = 4$

$\rightarrow (x + 1)^2 + 4$

(b)  $\frac{(x+2)(x+3) - x \times x}{x(x+3)} \rightarrow \frac{5x+6}{x(x+3)}$

15.

(a)(i)  $\overline{OE} = \overline{OD} + \overline{DE} \rightarrow a + a + c = 2a + c$

(ii)  $\overline{AC} = \overline{AO} + \overline{OC} \rightarrow -a + c$  or more neatly,  $c - a$

(iii)  $a + \left(\frac{1}{3} \text{ of the answer in part (ii)}\right) \rightarrow a + \frac{1}{3}(c - a) \rightarrow \frac{2}{3}a + \frac{1}{3}c$

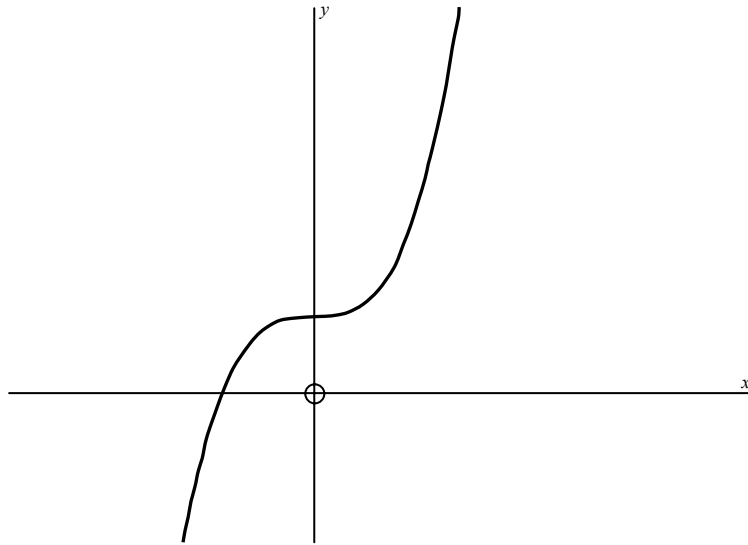
$\rightarrow \frac{1}{3}(2a + c)$

(b)(i) All these points lie on a straight line

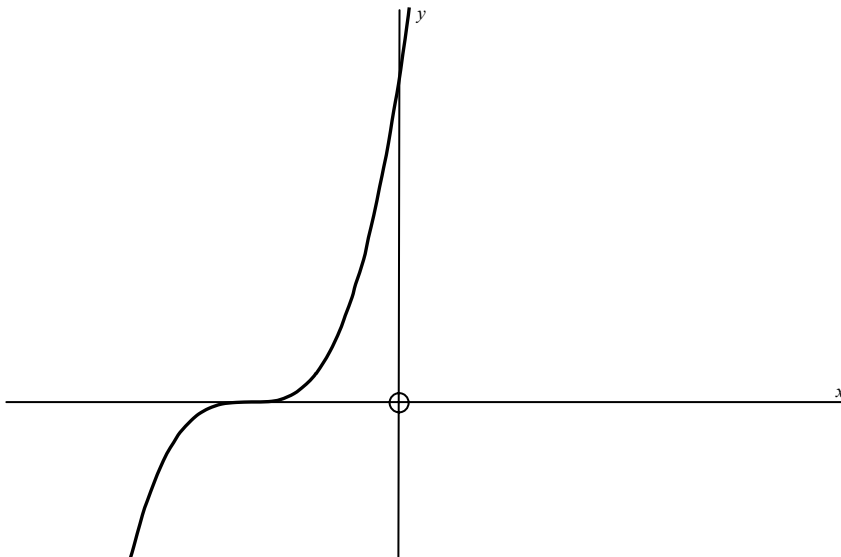
(ii) F is such a point on OA that OF : FE is in the ratio 1 : 2

16.

(a)



(b)



17.

(a) Look at the triangle. It is obvious the answer will be either 6 or 8, so prove it.

The partial circumference of the sector is in fact the entire circumference of the cone

$$\rightarrow 2\pi(10) \times \frac{216}{360} = 12\pi \rightarrow 2\pi r = 12\pi \rightarrow r = \frac{12\pi}{2\pi} \rightarrow r = 6\text{cm}$$

(b)(i) 8cm

(ii) Using the formula  $\frac{1}{3}\pi r^2 h \rightarrow \frac{1}{3}\pi(6^2)(8) \rightarrow 96\pi\text{cm}^3$

END OF PAPER 5 SOLUTIONS