Name: Solutions

GCSE 9-1 Higher
Practice Paper
Set D
Paper 3 - Calculator

Corbettmaths

Equipment

1. A black ink ball-point pen.
2. A pencil.
3. An eraser.
4. A ruler.
5. A pair of compasses.
6. A protractor.
7. A calculator

Guidance

1. Read each question carefully.
2. Don't spend too long on one question.
3. Attempt every question.
4. Check your answers seem right.
5. Always show your workings

Information

1. Time: 1 hour 30 minutes
2. The maximum mark for this paper is 80.
3. The marks for questions are shown in brackets
4. You may use tracing paper.

Question	Mark	Available
1		3
2		2
3		6
4		3
5		4
6		3
7		4
8		8
9		5
10		3
11		5
12		4
13		3
14		6
15		5
16		4
17		6
18		4
19		2
Total		80

1. (a) Write 48 as a product of primes.

48
(2) 24
(2) 12
(2) 6
(2)(3)
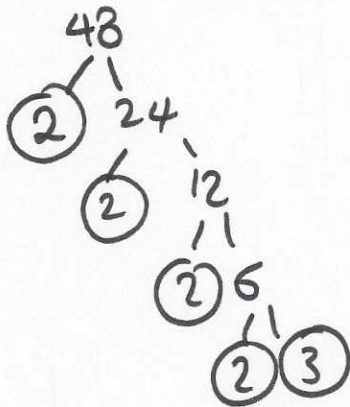
$2^4 \times 3$ ....
(1)

(b) Find the LCM of 48 and 180

$180 = 2 \times 2 \times 3 \times 3 \times 5$

$48 = 2 \times 2 \times 2 \times 2 \times 3$

$L.C.M. = 2^4 \times 3^2 \times 5 =$

720 ....
(2)

2. An energy bar contains 5.4g of protein.
15% of the bar is protein.

What is the total mass of the bar?

$\div 15$ ⎰ 5.4g is 15%
       ⎱ 0.36g is 1%

$\times 100$ ⎰ 36g is 100%

36 ....g
(2)

3. (a) Complete this table of value for $y = x^2 - 2x - 2$

x	-2	-1	0	1	2	3
y	6	1	-2	-3	-2	1

(2)

(b) On the grid, draw the graph of $y = x^2 - 2x - 2$ for the values –2 to 3
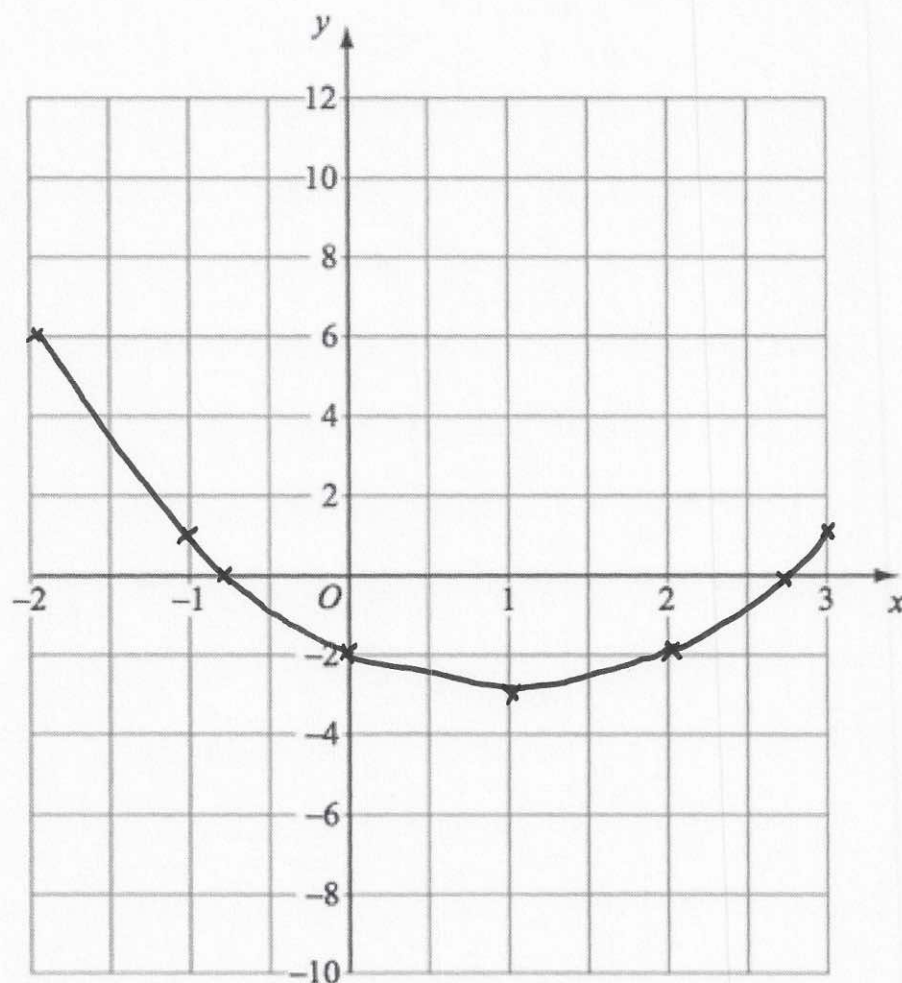
(2)

(c) Use the graph to estimate the solutions to $x^2 - 2x - 2 = 0$

2.7, -0.7

(2)

4. In Year 8 there are two classes, 8A and 8B
There are 20 students in Class 8A and 30 students in Class 8B.

The mean number of books read each month in Class 8A is 3.75
The mean number of books read each month in Year 8 is 3.2

Work out the mean number of books read each month in Class 8B.
Give your answer to 2 decimal places.

8A: total = $20 \times 3.75 = 75$ books

both classes together: total = $3.2 \times 50 = 160$ books

∴ total for 8B = $160 - 75 = 85$

$85 \div 30 = 2.83333...$

........2.83........

(3)

5. Here is a right angled triangle.

8cm

x
50

y

x - 10
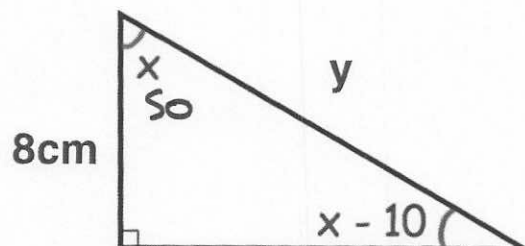
Work out the length of the side labelled y.

$2x - 10 = 90$
$x = 50$

$\cos x = \frac{a}{h}$ $y = \frac{8}{\cos 50} = 12.4457...$

........12.45 cm........

(4)

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6.   The table shows information on the number prizes given out in prize day.

Year Group	Frequency	angle
7	5	×7.2 = 36
8	17	122.4
9	20	144
10	8	57.6
	50	

Draw a pie chart for this information

$360 \div 50 = 7.2$

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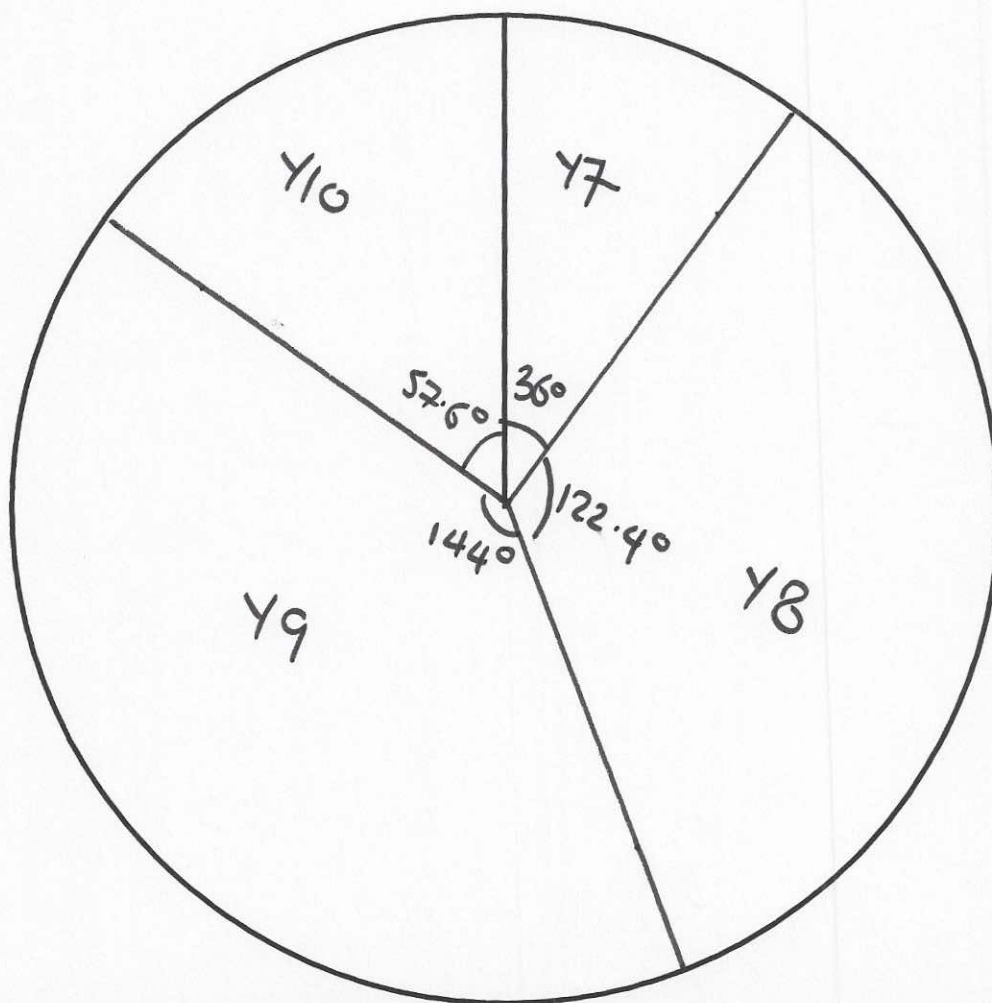
(3)

7. Mr.Dixon is building a toy boat for his son.
He has three different planks of wood to choose from.

Plank A	Plank B	Plank C
Volume = 750cm^3	Volume = 0.0152m^3	Volume = 1000cm^3
Mass = 900g	Mass = 7.6kg	Mass = 1.02kg

If wood has a density under 1g/cm³, it will float.

Which plank of wood is the most suitable?
Explain your answer.

$$density = \frac{Mass}{volume}$$

A: $\frac{900}{750} > 1$ (won't float)

B: $0.0152m^3 = 15200 cm^3$ ∴ density $= \frac{7600}{15200} < 1$

C: $\frac{1020}{1000} > 1$ (won't float)

Plank ......B..........

(4)

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8. (a) Expand and simplify $(x-1)(3x-1)(x-4)$

$$(x-1)(3x-1) = 3x^2 - x \cdot 3x + 1$$
$$= 3x^2 - 4x + 1$$

$$(3x^2 - 4x + 1)(x-4) = 3x^3 - 12x^2$$
$$- 4x^2 + 16x$$
$$+ x \cdot 4$$

$$3x^3 - 16x^2 + 17x - 4$$

(3)

(b) Simplify $(3x^4)^3$

$$27x^{12}$$

(2)

(c) Solve $3x^2 + 2x - 7 = 0$
Give your solutions correct to 2 significant figures.

$$x = \frac{-2 \pm \sqrt{2^2 - 4 \times 3x - 7}}{2 \times 3} = \begin{array}{l} 1.2301 \ldots \\ \text{or} \\ -1.8968 \ldots \end{array}$$

$$x = 1.2 \text{ or } x = -1.9$$

(3)

9. $f(x) = 1 + cosx°$

(a) Find $f(100)$
   Give your answer to 3 decimal places.

$1 + cos(100) =$

0.826
(1)

$g(x) = tanx°$

(b) Find $fg(88)$
   Give your answer to 3 decimal places.

$tan\ 88 = 28.636\ ...$

$1 + cos(28.63..) =$

1.878
(2)

$h(x) = 2x + 1$

(a) Find the value of **a** such that $h(a) = h^{-1}(a)$

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

$\therefore h^{-1}(x) = \frac{x-1}{2}$

$2x + 1 = \frac{x-1}{2}$

$4x + 2 = x - 1$

$3x = -3$

$x = -1$

$a = -1$
(2)

10. The amount of money at the start of year t is A_t
The amount of money in the bank account at the start of year 1 is £5000

Given that

$$A_{t+1} = 1.02A_t$$

work out the amount of money in the bank account at the start of year 4.

$A_1 = 5000$

$A_2 = 1.02 \times 5000$

$A_3 = 1.02^2 \times 5000$

$A_4 = 1.02^3 \times 5000 =$

£ 5306.04

(3)

11. q is inversely proportional to the square of t.
When q = 7.5, t = 1.6

(a) Calculate the value of q when t = 8

$q \propto \dfrac{1}{t^2}$ $q = \dfrac{k}{t^2}$ $k = qt^2$

$= 7.5 \times 1.6^2 = 19.2$

$\therefore q = \dfrac{19.2}{t^2}$ $q = \dfrac{19.2}{8^2} = 0.3$

0.3

(3)

(b) Calculate the value of t when q = 1.875

$1.875 = \dfrac{19.2}{t^2}$ $t^2 = \dfrac{19.2}{1.875} = \dfrac{256}{25}$

t = 3.2

(2)

12. Prove that when two consecutive integers are squared, that the difference is equal to the sum of the two consecutive integers.
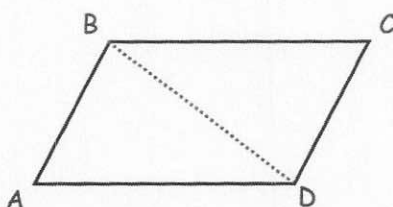
2 consecutive integers n and $(n+1)$

$(n+1)^2 - n^2 \equiv n^2 + 2n + 1 - n^2 = 2n + 1$

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

∴ the difference of their squares is equal to their sum

(4)

13. ABCD is a parallelogram.

Prove that triangles ABD and BCD are congruent.

BD is common

AB = CD   (opposite sides of a parallelogram
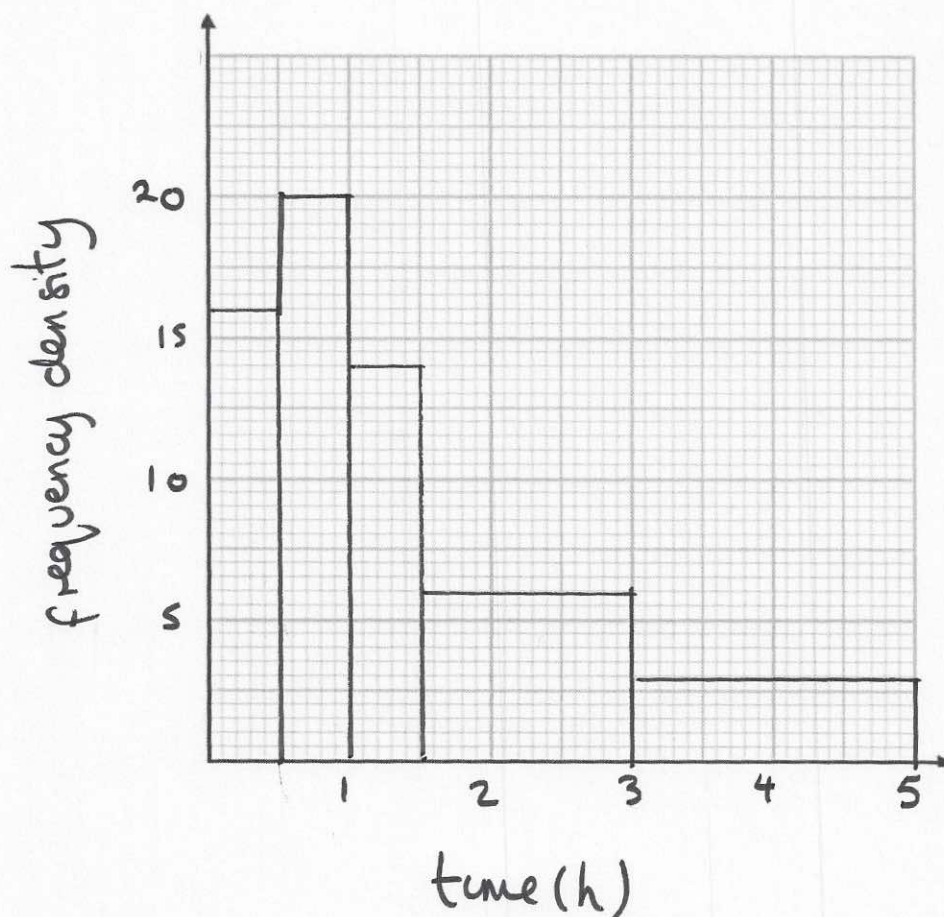AD = BC   are equal)

∴ ABD ≡ BCD   (SSS)

(3)

14. The waiting times, *h* hours, for 40 patients at an accident and emergency department in one evening is shown below.

Waiting time, h	Frequency
$0 < h \le 0.5$	8
$0.5 < h \le 1$	10
$1 < h \le 1.5$	7
$1.5 < h \le 3$	9
$3 < h \le 5$	6

f.d
16
20
14
6
3

(a) Draw a histogram for this data.

time (h)
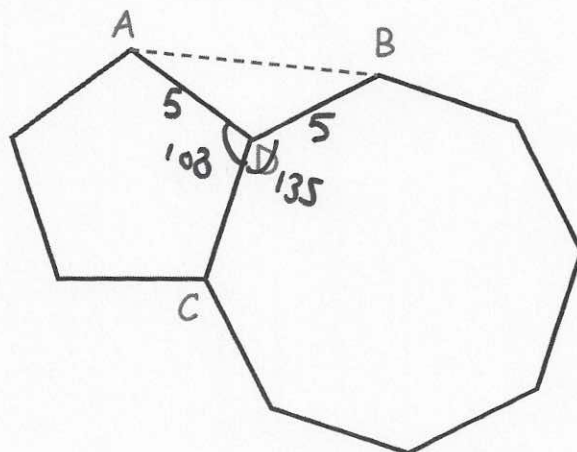
(3)

Two patients are selected at random to complete a survey.

(b) Find the probability that both patients had a waiting time of over 1.5 hours.

$$\frac{15}{40} \times \frac{14}{39} =$$

$$\frac{7}{52}$$

....

(3)

15. A is a vertex of a regular pentagon.
B is a vertex of a regular octagon.
C and D are vertices of both polygons.

The perimeter of the octagon is 40cm.

Work out the length AB

$BD = DC = AQ = 40 \div 8 = 5$

$A\hat{D}B = 360 - 108 - 135 = 117$

$AB^2 = 5^2 + 5^2 - 2 \times 5 \times 5 \times \cos 117$

$= 72.69952..$

$\sqrt{72.699} = 8.5264..$ $AB = 8.5$

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

(5)

16. Sophie estimated that the distance between Bristol and Newcastle is about 290 miles and that her average driving speed would be 50 mph.

She estimated the distance to the nearest 10 miles and the speed to the nearest 5 mph.

Calculate the lower bound of the time the journey should take.
Give your answer in hours and minutes.
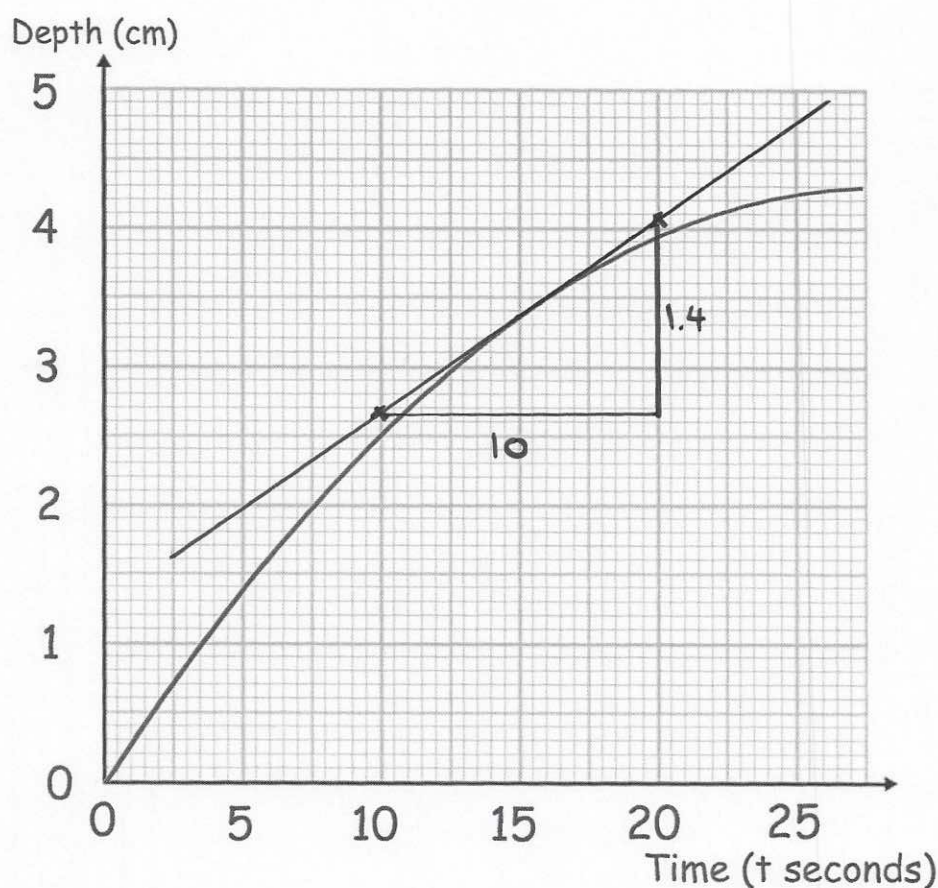Give your answer to the nearest minute.

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

$$\text{time}_{lower} = \frac{\text{distance}_{lower}}{\text{speed}_{upper}} = \frac{285}{52.5} = 5.42857142..$$

...........5...........hours ......26....minutes

(4)

17. Jack is filling a container with water.

The graph shows the depth of the water, in centimetres, t seconds after the start of filling the container.

(a) Calculate an estimate for the gradient of the graph when t = 15 seconds.

$$\text{gradient} = \frac{1.4}{10}$$

........0.14........
                                                    (3)

(b) Describe fully what your answer to (a) represents

The rate at which the depth is increasing (in cm/s)
                                                    (2)

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

as the tangent is only drawn by eye
                                                    (1)

18. Solve the equations

$$2x + y = 11$$
$$2x^2 - y^2 = 23$$

$y = 11 - 2x$

$2x^2 - (11 - 2x)^2 = 23$

$2x^2 - (121 - 44x + 4x^2) = 23$

$-2x^2 + 44x + 144 = 0$

$x^2 - 22x + 72 = 0$

$(x - 18)(x - 4) = 0$
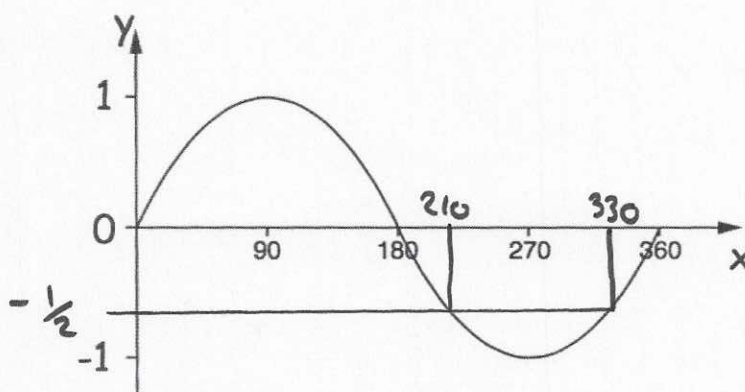
$x = 4 \quad y = 11 - 2 \times 4 = 3$

$x = 18 \quad y = 11 - 2 \times 18 = -25$

$x = 4 \quad y = 3$

$x = 18 \quad y = -25$

....

(4)

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19. Here is the graph of $y = sin(x)$ for $0 \le x \le 360$

One solution of $sin x = -0.5$ is $x = 330°$
Find another solution of $sin x = -0.5$

x = ...210°.............

(2)