Answer **all** questions in the spaces provided

1 Circle the decimal that is closest in value to $\frac{11}{20}$ $\times 5 = \frac{55}{100} = 0.55$

[1 mark]

(0.56)   0.6   0.525   0.5

2 Circle the list of **all** the integers that satisfy $-2 < x \leqslant 4$

$-1, 0, 1, 2, 3, 4$ **[1 mark]**

$-2, -1, 0, 1, 2, 3$ $-1, 0, 1, 2, 3$

$-2, -1, 0, 1, 2, 3, 4$ $(-1, 0, 1, 2, 3, 4)$

3 Circle the largest number.

[1 mark]

$(3.2\dot{7})$ 3.27 3.277 $3.20\dot{7}$

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AQA

GCSE
MATHEMATICS

H

Higher Tier   Paper 3 Calculator

Tuesday 12 June 2018   Morning   Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24–25	
TOTAL	

8300/3H

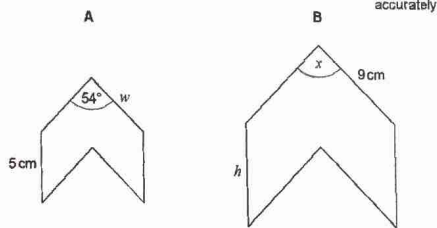**6** A and B are similar shapes.

B is an enlargement of A with scale factor 1.5

A   B   Not drawn accurately

$54°$ w x 9cm

5cm h

Work out the values of x, h and w.

[3 marks]

Similar shapes angles always the same

$5 \times 1.5 = 7.5$

$9 \div 1.5 = 6$

$x =$ ___54___ degrees

$h =$ ___7.5___ cm

$w =$ ___6___ cm

---

4 What is the size of an exterior angle of a regular decagon?

Circle your answer.

[1 mark]

$\frac{360}{10} = 36$ 18° (36°) 144° 162°

5 a is a common factor of 72 and 120

b is a common multiple of 6 and 9

Work out the highest possible value of $\frac{a}{b}$

[4 marks]

$c.f$ 72 and 120   HCF

2, 3, 4, 6, 8, 12, 24

6 and 9   HCF $\frac{24}{18} = \frac{4}{3}$

LCM → 18, 36, 54 ...   LCM

Answer ___$\frac{4}{3}$___

Turn over for the next question

8

Turn over ▶

8 (a) Show that the lines $y = 3x + 7$ and $2y - 6x = 8$ are parallel.

Do **not** use a graphical method.

[3 marks]

gradient

$y = 3x + 7$

$2y - 6x = 8$

$\quad +6x \quad +6x$

$2y = 6x + 8$

$\div 2 \qquad \div 2$

$y = 3x + 4$

Both Have gradient of 3

8 (b) Is the point $(-5, -6)$ above, below or on the line $y = 3x + 7$?

Tick **one** box.

[✓] Above   [ ] Below   [ ] On the line

You **must** show your working.

Do **not** use a graphical method.

[2 marks]

On the line ? $-6 = 3(x-5) + 7$

$-6 = -15 + 7$

$9 = 7$ no ∴ not on the line

above or below: $y = (3 \times -5) + 7$

$y = -8$

on the line would be $(-5, -8)$

this point $(-5, -6)$

-6 is above -8

7

Investment A   Save £150 per month for 2 years.

2.5% interest is added to the total amount saved.

Investment B   Invest £3500

Compound interest is added at 3% per year.

After 2 years, how much **more** is investment B worth than investment A?

[4 marks]

A: $150 \times 24 = 3600 \times 1.025 = 3690$

B: $3500 \times 1.03^2 = 3713.15$

$3713.15 - 3690 = £23.15$

Answer £ _____23.15_____

Turn over for the next question

11 $a = \begin{pmatrix} 6 \\ -10 \end{pmatrix}$ $b = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ $c = \begin{pmatrix} -4 \\ 7 \end{pmatrix}$

11 (a)   Work out $a + b + c$

         [2 marks]

$$\begin{pmatrix} 6 \\ -10 \end{pmatrix} + \begin{pmatrix} -1 \\ 2 \end{pmatrix} + \begin{pmatrix} -4 \\ 7 \end{pmatrix} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

Answer $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$

11 (b)   Show that $a + 2c$ is parallel to **b**

         [2 marks]

$a + 2c$

~~(scribbled out working)~~

$$2c = 2 \begin{pmatrix} -4 \\ 7 \end{pmatrix} = \begin{pmatrix} -8 \\ 14 \end{pmatrix}$$

$$\begin{pmatrix} 6 \\ -10 \end{pmatrix} + \begin{pmatrix} -8 \\ 14 \end{pmatrix} = \begin{pmatrix} -2 \\ 4 \end{pmatrix} \qquad b = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$$

$4 + 2c$ and b are multiples $\therefore$ parallel

---

9   The cost of a ticket increases by 10% to £19.25

Work out the original cost.

         [3 marks]

$19.25 = 110\%$

$\div 110$ $\div 110$

$\times 100$ $17.50 = 100\%$ $\times 100$

Answer £   17.50

10   The nth term of a sequence is $12n - 5$

Work out the numbers in the sequence that
         have two digits
         and
         are **not** prime.

         [3 marks]

$1 = 7$
$2 = 19$
$3 = 31$
$4 = 43$
$5 = 55$
$6 = 67$
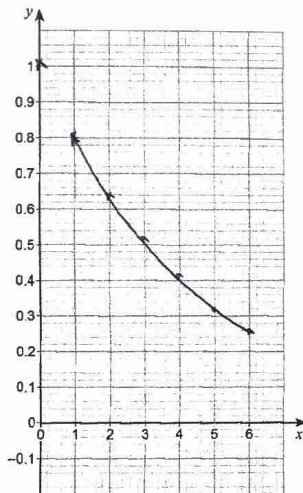$7 = 79$
$8 = 91$
$9 = 103$

Answer   55   and   91

11

14 Draw the graph of $y = 0.8^x$ for values of x from 0 to 6

[3 marks]

x	0	1	2	3	4	5	6
y	1	0.8	0.64	0.512	0.4096	0.328	0.262

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12

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

A force of 40 Newtons is applied to an area of 3.2 square metres.

Work out the pressure.

Give the units of your answer.

[2 marks]

$40 \div 3.2 = 12.5 \ ^N/_{m^2}$

Answer $12.5 \ N/m^2$ (or Nm^{-2})

13 Tick **all** the statements that are true for any rhombus.

[1 mark]

☑ The diagonals are lines of symmetry

☑ The diagonals bisect each other

☑ The diagonals are perpendicular

☐ The diagonals are equal in length

Turn over for the next question

7

Turn over ▶

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17 Here are two methods to make a 4-digit code.

Codes can have repeated digits.

Method A
For the first two digits use an odd number between 30 and 100
For the last two digits use a multiple of 11

Method B
Use four digits in the order   even   odd   even   odd
Do **not** use the digit zero

Which method gives the **greater** number of possible codes?
You **must** show your working.

[3 marks]

Method A : $30 \rightarrow 100$ 35 odd posiblties

$11 \rightarrow 99$ 9 possibities

$35 \times 9 = 315$

Method B :   start   2 1 2 1
                              4 3 4 3
$4 \times 5 \times 4 \times 5 = 400$ 4 6 5 5 4 6 5 5
$400 > 315$ 8 7 8 7
                                                              9 9
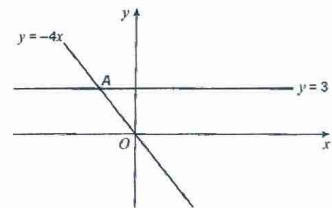
Answer _____ B

---

15 Amy has x beads.

Billy has three more beads than Amy.

Carly has four times as many beads as Billy.

Circle the expression for the number of beads that Carly has.

[1 mark]

$4x + 3$ $3x + 4$ $4(x + 3)$ $x + 12$

16 Two straight lines intersect at point A.

Not drawn
accurately

Circle the coordinates of A.

[1 mark]

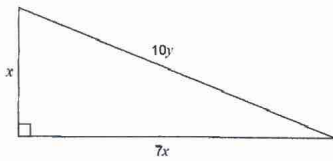$\left(-\frac{3}{4}, 3\right)$ $(-4, 3)$ $(-12, 3)$ $\left(-\frac{4}{3}, 3\right)$

$y = 3$

$3 = -4x$

$x = -\frac{3}{4}$

Turn over ►

20 All dimensions are in centimetres.

Not drawn accurately

Use Pythagoras' theorem to work out the exact value of $\frac{x}{y}$

[3 marks]

$$(10y)^2 = x^2 + (7x)^2$$

$$100y^2 = x^2 + 49x^2$$

$$100y^2 = 50x^2 \qquad \frac{100}{50} = \frac{x^2}{y^2}$$

$$\div 50 \qquad \div 50$$

$$\div y^2 \qquad \div y^2$$

$$2 = \frac{x^2}{y^2}$$

Answer $\sqrt{2}$

$$\sqrt{2} = \frac{\sqrt{x^2}}{\sqrt{y^2}}$$

$$\boxed{\sqrt{2}} = \frac{x}{y}$$

18 Show that, for $x \neq 0$

$$\frac{x+4}{3x} - \frac{5}{2x}$$

can be written in the form $\frac{ax+b}{cx}$ where a, b and c are integers.

[3 marks]

$$\times 2\left(\frac{x+4}{3x}\right) - \left(\frac{5}{2x}\right)\times 3$$

$$\frac{2(x+4)}{6x} - \frac{10}{6x}$$

$$\frac{2x+8}{6x} - \frac{15}{6x} = \frac{2x-7}{6x}$$

Answer $\dfrac{2x-7}{6x}$

19 The equation of a straight line is $\quad 3x + 2y = 24$
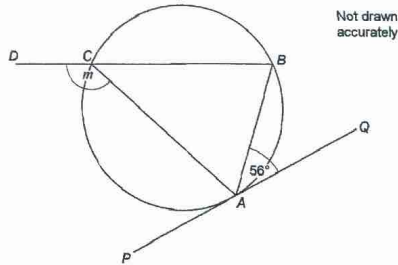
Circle the point where the line crosses the x-axis.

[1 mark]

(0, 8)   (12, 0)   (0, 12)   (8, 0)

7

22 A, B and C are points on a circle.

DCB is a straight line.

PAQ is a tangent to the circle.

Not drawn accurately

Sam is trying to work out the size of angle m.

Here is his working.

angle $ACB = 56°$	angles in the same segment are equal
$m = 180° - 56°$	angles at a point on a straight line add up to 180°
$m = 124°$	

Make a criticism of his working.

[1 mark]

Incorrect First theorem stated

Should be "Alternat Segment theory"

---

21 The mass of an ornament is m grams.

The height of the ornament is h centimetres.

m is directly proportional to the cube of h.

$m = 1600$ when $h = 8$

21 (a) Work out an equation connecting m and h.

[3 marks]

$m \propto h^3$

$m = K h^3$

$1600 = K\, 8^3$

$\dfrac{1600}{8^3} = K$

$K = 3125$

$m = 3.125\, h^3$

Answer ____$m = 3.125\, h^3$____

21 (b) Work out the mass of an ornament of height 12 centimetres.

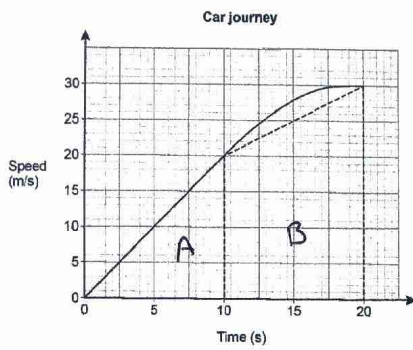[2 marks]

$m = 3.125\, h^2$

$m = 3.125 \times 12^3$

Answer ____5400____ grams

Turn over for the next question

8

24 The speed-time graph shows 20 seconds of a car journey.

Harry wants to estimate the distance the car travels in this time.

He uses a triangle and a trapezium, as shown, to estimate the area under the graph.

Car journey

24 (a) Complete Harry's method to estimate the distance the car travels.

[3 marks]

$A = \frac{1}{2}(10 \times 20) = 100$

$B \quad \frac{1}{2}(20 + 30) \times 10 = 250$

$100 + 250 = 350$

Answer _____ 350 _____ m

---

23 A sequence of numbers is formed by the iterative process

$$u_{n+1} = \frac{3}{u_n + 1}, \qquad u_1 = 4$$

Work out the values of u_2 and u_3

[2 marks]

$u_2 = \frac{3}{4+1} = 0.6$

$u_3 = \frac{3}{0.6 \times 1} = 1.875$

$u_2 = $ _____ 0.6 _____

$u_3 = $ _____ 1.875 _____

Turn over for the next question

25 ABCDEF is a triangular prism which represents part of a hill.

ABCF is the horizontal rectangular base.

D is vertically above C.
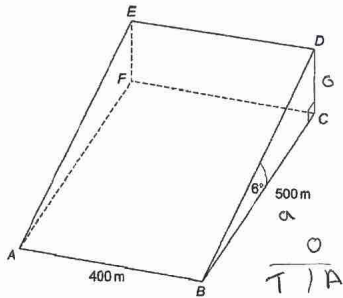
25 (a) Work out the height CD.

[2 marks]

$$O = \text{Tan}(6) + 500 = 52.5521...$$

Answer _____ 52.6 _____ m

24 (b) For this journey, which of these is true for Harry's method?

Tick **one** box.

[1 mark]

☐ It works out an overestimate of the distance

☑ It works out an underestimate of the distance

☐ It could work out an overestimate or an underestimate of the distance

Turn over for the next question

4

Turn over ▶

26 The histogram shows information about the speed of cars as they pass a checkpoint.
The scale on the frequency density axis is missing.

Speed of cars

Frequency
density

Speed (mph)
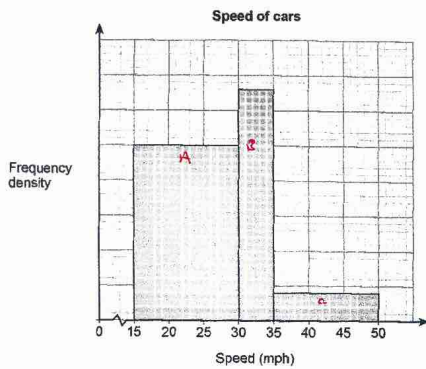
The histogram shows information about 480 cars.

26 (a) How many cars does the first bar represent?

[4 marks]

Count Small Squares $480 \div 600 = 0.8$

A = $15 + 25 = 375$ $\times 0.8 = \boxed{300}$
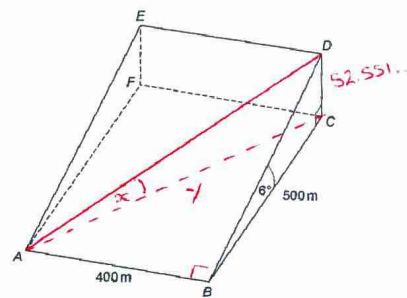
B = $(7 \times 25) - 10 = 165$ $\times 0.8 = 132$

C = $(6 + 25) - 15 = 60$ $\times 0.8 = 48$

                    600

Answer _____ 300 _____

25 (b) Jamil walks in a straight line from *A* to *D*.

Work out the size of angle *DAC*.
You **must** show your working.

[4 marks]

$y^2 = 400^2 + 500^2$

$y = \sqrt{400^2 + 500^2} = 640.31$

TTA = $\tan(x) = \dfrac{52.551}{640.31}$

$x = \tan^{-1}\left(\dfrac{52.551}{640.31}\right)$

$x = 4.6917$

$x = 4.7$ 2 sig figs

Answer _____ 4.7 _____ degrees

27 A bag contains 30 discs.

10 are red and 20 are blue.

One disc is taken out at random and replaced by **two** of the other colour.

Another disc is then taken out at random and replaced by **two** of the other colour.

Another disc is then taken out at random.

Work out the probability that all three discs taken out are **red**.

[3 marks]

R   B   10/30
10   20

          +2

-1

9   22   9/31

-1   8   24   +2   8/32

              10/30 × 9/31 × 8/32 = 3/124

Answer   3/124

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---

26 (b) Cars with a speed greater than 40 mph are over the speed limit.

Use the histogram to estimate the number of cars that are over the speed limit.

[2 marks]

40 little squares over 40 mph

40 × 0.8 = 32

Answer   32

Turn over for the next question

6

Turn over ▶
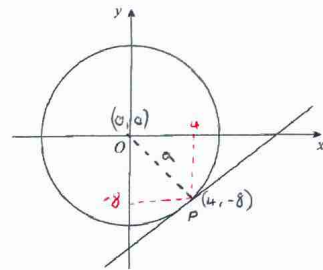
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There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

---

28 P is a point on the circle with equation $x^2 + y^2 = 80$

P has x-coordinate 4 and is below the x-axis.

Not drawn accurately

Work out the equation of the tangent to the circle at P.

[5 marks]

$x^2 + y^2 = 80$

$4^2 + y^2 = 80$

$y^2 = 80 - 16$

$y = -8$

line a gradient $= \dfrac{-8}{4} = -2$

tangent is perpendicular

$\therefore$ gradient $= -\dfrac{1}{2} = \dfrac{1}{2}$

Tangent gradient $= \dfrac{1}{2}$ $x = 4$ $y = -8$

$y = mx + c$

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

$-8 = \frac{1}{2} + 4 + c$

$-8 = 2 + c$

$c = -10$

Answer $\qquad y = \frac{1}{2}x - 10$

END OF QUESTIONS

8