Name	
Class	

GCSE PRACTICE PAPER MATHEMATICS

WJEC STYLE

UNIT 2: CALCULATOR ALLOWED HIGHER TIER

MAY 2018

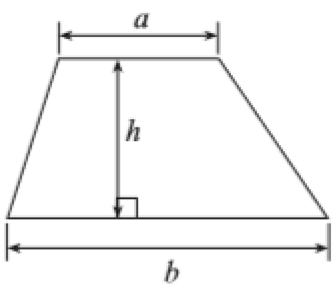
1 hour 45 minutes

Worked solutions

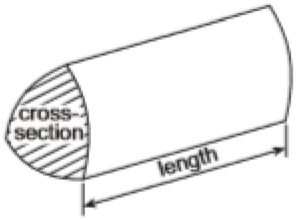
Question	Maximum Mark	Mark Awarded
1.	4	
2.	3	
3.	4	
4.	5	
5.	5	
6.	3	
7.	7	
8.	5	
9.	7	
10.	3	
11.	3	
12.	5	
13.	4	
14.	5	
15.	6	
16.	4	
17.	7	
Total	80	

Formula List - Higher Tier

Area of trapezium $= \frac{1}{2}(a + b)h$



Volume of prism = area of cross-section × length

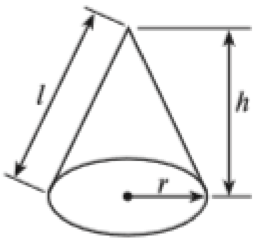


Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$

Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$

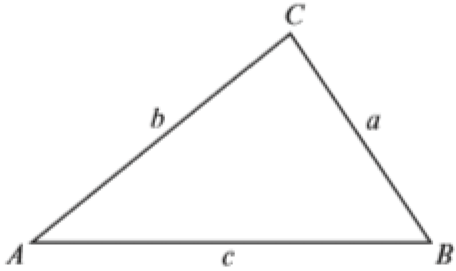


In any triangle ABC

Sine rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle $= \frac{1}{2} ab \sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1+\frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

1. *(a)* Calculate $\frac{3.4^2 - (8.2 \times -1.5)}{\sqrt{3.5}}$, correct to 2 significant figures. [2]

12.7537064641 = 13 (2sf)

(b) Calculate the reciprocal of π, correct to 2 decimal places. [2]

$\frac{1}{\pi}$ = 0.31830988618 = 0.32 (2dp)

2. Circle the correct answer for each of the following.

(a) $x^6 \times x^{-2} =$ [1]

x^{-62} x^{-3} $x^{-\frac{1}{3}}$ x^{-12} x^4

$x^6 \times x^{-2} = x^{6+-2} = x^4$

(b) $(8x - 2y) - (10x + y) =$ [1]

$2x - y$ $2x + y$ $-2x - 3y$ $-2x + 3y$ $-2x - y$

$8x - 10x = -2x$

$-2y - +y = -3y$

(c) A car travels y miles in 20 minutes.
Its average speed in miles per hour is [1]

$\frac{y}{3}$ $\frac{y}{20}$ $\frac{3}{y}$ $3y$ $20y$

20 minutes is one third of an hour, so in 1 hour it would travel 3y miles.

3. A solution to the equation

$$x^3 - 7x = 2$$

lies between 2 and 3.

Use the method of trial and improvement to find this solution correct to 1 decimal place.

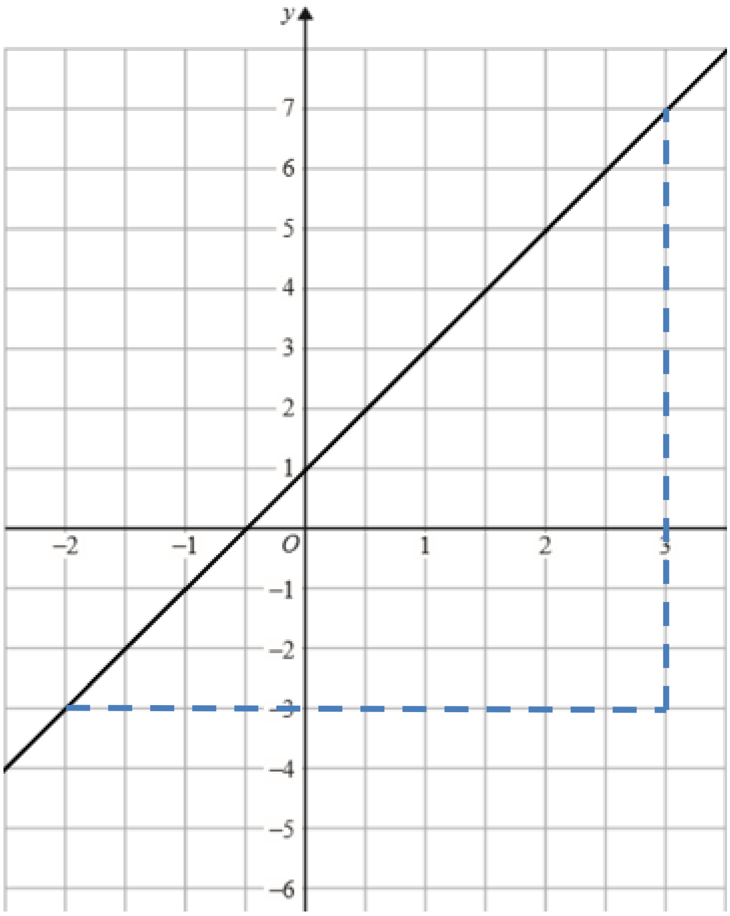
You must show all your working. [4]

x	$x^3 - 7x$	Larger/smaller than 2
2.5	$2.5^3 - 7(2.5) = -1.875$	S
2.6	$2.6^3 - 7(2.6) = -0.624$	S
2.7	$2.7^3 - 7(2.7) = 0.783$	S
2.8	$2.8^3 - 7(2.8) = 2.352$	L
2.75	$2.75^3 - 7(2.75) = 1.546875$	S

Therefore, x lies between 2.75 and 2.8 ; $x = 2.8\ (1dp)$

Note: All numbers between 2.75 and 2.8 round to 2.8 (1.d.p)

4. (a) The diagram below shows the graph of a straight line for values of x from −2.5 to 3.5.



(i) Write down the gradient of the above line. [1]

$\frac{7--3}{3--2} = 2$

(ii) Write down the equation of the line in the form $y = mx + c$, where m and c are whole numbers. [2]

$y = 2x + 1$

(b) Without drawing, show that the line $3y = 15x + 8$ is parallel to the line $2y = 10x - 3$.
You must show working to support your answer. [2]

$3y = 15x + 8$ $2y = 10x - 3$

$y = 5x + \frac{8}{3}$ $y = 5x - \frac{3}{2}$

Divide each term by 3 Divide each term by 2

Since both gradients are the same, the lines are parallel.

5. Mohamed is a professional football player. He claims that, in any match, he can score at least one goal with a probability of 80%.

Jurgen challenges him to prove this by playing 50 matches of football.

Mohamed's results are given in the following table.

Number of matches played	10	10	10	10	10
Number of goals scored	6	11	13	6	5

Jurgen creates a table to show the cumulative number of goals scored and relative frequencies.

Total number of matches played	10	20	30	40	50
Total number of goals scored	6	17	**30**	**36**	**41**
Relative frequency of scoring a goal	$\frac{6}{10}$	$\frac{17}{20}$	$\frac{30}{30}$	$\frac{36}{40}$	$\frac{41}{50}$
	0.6	0.85	**1**	**0.9**	**0.82**

(a) Complete the table above [3]

(b) Using the results above, write down the best estimate for the probability of Mohamed scoring a goal in his next game. You must give a reason for your choice. [2]

Probability: 0.82

Reason: A greater number of experiments gives a more accurate estimate of probability.

6.

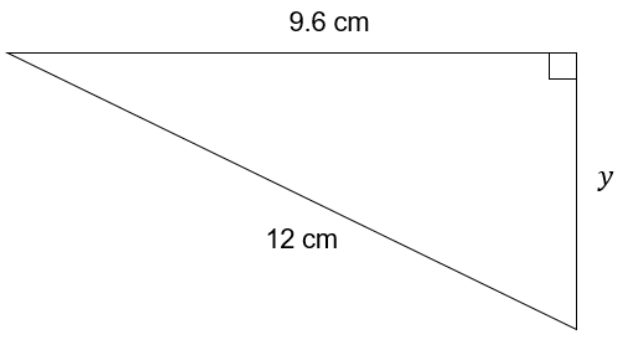


Diagram not drawn to scale

Calculate the length of the side marked y. [3]

$a^2 + b^2 = c^2$

$b^2 = c^2 - a^2$

$b^2 = 12^2 - 9.6^2 = 51.84$

$$b = \sqrt{51.84} = 7.2$$

7. Concert goers have been given three ways in which they can get their tickets for an upcoming concert. They have the following three options:

- Receive them in the post,
- Collect them from the ticket office or
- Download an online ticket.

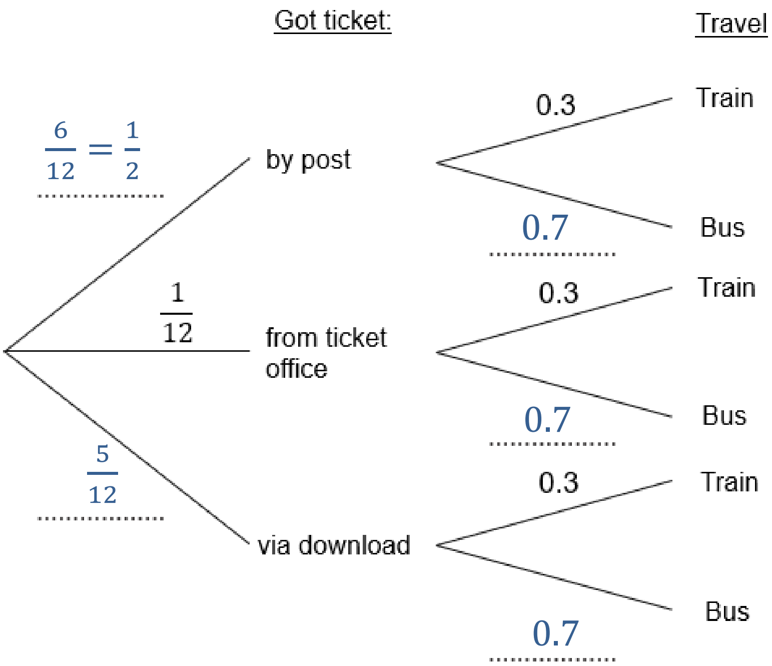
All of the concert goers travel to the concert by train or by bus.
The decision to travel by train or by bus is independent of the way they get their tickets.

One of the concert goers was selected at random.
The probability that this concert goer receives their tickets via a download **and** travels by train is $\frac{1}{8}$.

The probability that a concert goer collects their tickets from the ticket office is $\frac{1}{12}$.

(a) Complete the tree diagram shown below. [4]

$\frac{1}{8} \div 0.3 = \frac{5}{12}$



(b) What is the probability that a concert goer **does not** collect their tickets from the ticket office **and** travels to the concert on a bus? Write your answer as a fraction. [3]

$1 - (\frac{1}{2} \times 0.7 + \frac{5}{12} \times 0.7) = \frac{43}{120}$

8. Find the answer to the following number problem. [5]

'(the LCM of 6, 12 and 15) ÷ (the HCF of 240 and 360)'.

The lowest common multiple of 6, 12 and 15 is 60

The highest common factor of 240 and 360 is 120

60 ÷ 120 = 0.5

9. (a) Factorise x^2 – 6x – 16, and hence solve x^2 – 6x – 16 = 0. [3]

$x^2 - 6x - 16 = (x - 8)(x + 2) = 0$

$x = 8 \text{ and } x = -2$

`

(b) Solve the equation $\frac{4x-2}{3} + \frac{2x+1}{12} = \frac{19}{6}$ [4]

$\frac{4(4x-2)}{4(3)} + \frac{2x+1}{12} = \frac{2(19)}{2(6)}$

$\frac{4(4x-2)}{12} + \frac{2x+1}{12} = \frac{2(19)}{12}$

$4(4x - 2) + (2x + 1) = 2 \times 19$

$16x - 8 + 2x + 1 = 38$

$18x = 45$

$x = 2.5$

10. Calculate the length of side MN in the triangle LMN shown below. [3]

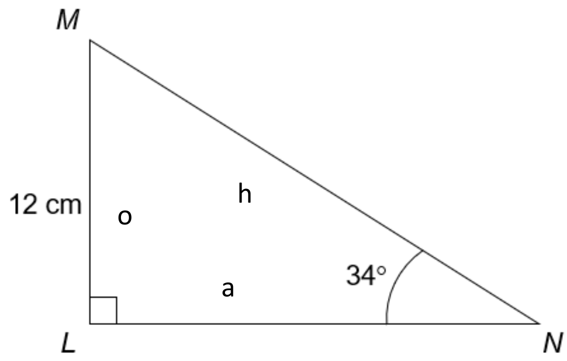


Diagram not drawn to scale

Let MN = x

$Sin(34) = \frac{12}{x}$

$x = \frac{12}{Sin\ 34}$

$x = 21.4594997997$

$MN = 21.46(2dp)$

11. A rectangular football pitch measures 105 m by 68 m. Each measurement is correct to the nearest 0.5 m. Calculate the greatest possible area of the pitch. [3]

105 correct to the nearest 0.5m = 105.25 (max) and 104.75 (min)

68 correct to the nearest 0.5m =68.25 (max) and 67.75 (min)

$$105.25 \times 68.25 = 7183.3125$$

$$7183.3125\ m^2$$

12. (a) Factorise $(x + 3)^2 - 5(x + 3)$. [2]

$$x^2 + 6x + 9 - 5x - 15 = x^2 + x - 6$$

$$x^2 + x - 6 = (x + 3)(x - 2)$$

or take $(x + 3)$ as a common factor

$$(x + 3)(x + 3 - 5)$$

$$(x + 3)(x - 2)$$

(b) Factorise $25x^2 - 12y^2$. [3]

$$25x^2 - 12y^2 = (5x - \sqrt{12}y)(5x + \sqrt{12}y)$$

13. Make x the subject of the following formula. [4]

$$b(c - x) = 3x(a + b)$$

$$bc - bx = 3x(a + b)$$

$$bc = 3x(a + b) + bx$$

$$bc = 3ax + 3bx + bx$$

$$bc = x(3a + 4b)$$

$$x = \frac{bc}{3a + 4b}$$

14. Points M and N lie on a circle, centre *O*.
The radius of the circle is 8 cm.
The area of the shaded sector is 45 cm^2.

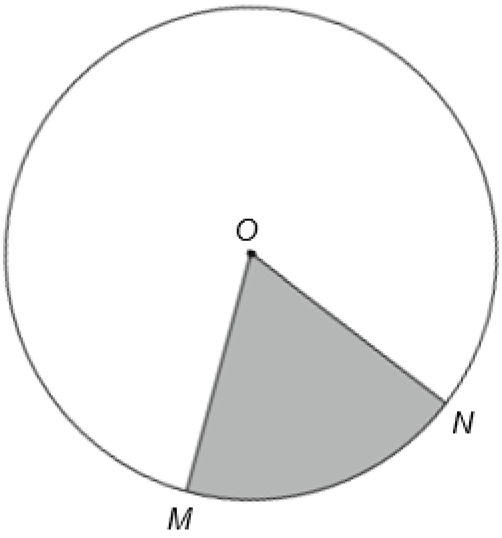


Diagram not drawn to scale

(a) Calculate the size of $M\hat{O}N$. [3]

$$\frac{45}{360°} \times \pi \times 8^2 = 80.5721899403$$

$$80.572 \ldots = 80.57°(2dp)$$

(b) Hence, calculate the length of the arc *MN*. [2]

$$(\pi \times 16) \times \frac{80.57}{360}$$

$$= 11.25cm$$

15. Use the quadratic formula to solve $(2x + 2)^2 = x(x - 3) - 1$
Give your answers correct to 2 decimal places. [6]

$$4x^2 + 8x + 4 = x^2 - 3x - 1$$

$$3x^2 + 11x + 5 = 0$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{-11 \pm \sqrt{11^2 - 4 \times 3 \times 5}}{2 \times 3}$$

$$\frac{-11 \pm \sqrt{121 - 60}}{6}$$

$$\frac{-11 \pm \sqrt{61}}{6}$$

$$\frac{-11 + \sqrt{61}}{6} = -0.5316 \ldots = -0.53\ (2dp)$$

$$\frac{-11 - \sqrt{61}}{6} = -3.1350 \ldots = -3.14(2dp)$$

16. Two similar shapes have volumes of 1944.81 cm^3 and 210 cm^3. The area of the larger shape is 286.65 cm^2. Calculate the area of the smaller shape. [4]

$$\frac{1944.81}{210} = 9.261$$

Volume scale factor = 9.261

Linear scale factor = 3√9.261 = 2.21

Area scale factor = 2.21^2= 4.41

$$286.65 \div 4.41 = 65cm^2$$

17. A 5-pointed star, with centre O, is shown below.
Each side of the star is of length w cm.

The distance from the centre to every outer vertex of the star is 9 cm.
The distance from the centre to every inner vertex of the star is 4 cm.

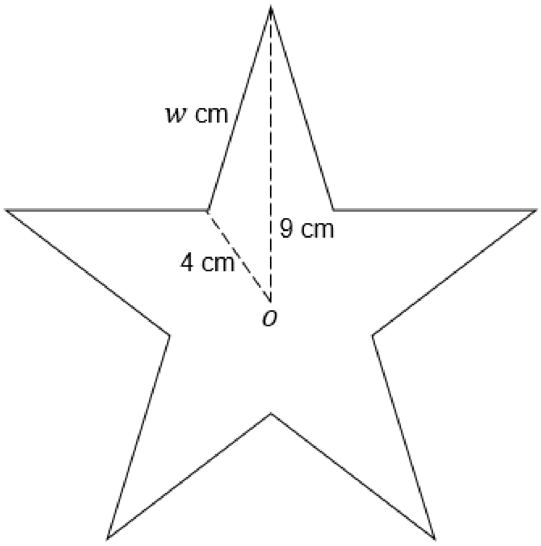


Diagram not drawn to scale

(a) Calculate the perimeter of the star. [5]

$$Angle\ at\ centre\ of\ star = \frac{360}{10} = 36°$$

$$a^2 = b^2 + c^2 - 2bc\cos(A)$$

$$a^2 = 4^2 + 9^2 - 2 \times 4 \times 9 \times Cos(36)$$

$$a^2 = 38.750776405$$

$$a = 6.22501216103cm$$

$$Perimeter = 10a = 62.25cm\ (2dp)$$

(b) Calculate the area of the star. [3]

$$Area\ of\ triangle = \frac{1}{2} \times 9 \times 4\sin(36)$$

$$Area\ of\ triangle = 10.5801345413$$

$$Area\ of\ star = 10 \times Area\ of\ triangle = 105.801\ ...$$

$$Area\ of\ star = 105.80cm^2\ (2dp)$$

END OF PAPER