GCSE (9-1) Mathematics

J560/06 Paper 6 (Higher Tier)

Question Set 1

1 (a) A grain of salt weighs 6.48×10^{-5} kg on average.
A packet contains 0.35 kg of salt.

(a) Use this information to calculate the number of grains of salt in the packet.

$$\frac{0.35}{6.48 \times 10^{-5}} = 5401.23$$

(a) 5401 grains of salt [2]

(b) **(b)** Explain why your answer to part **(a)** is unlikely to be the actual number of grains of salt in the packet.

Because not every grain of salt has the same size and same weight as the average value

[1]

2 Sophie is organising a raffle.

- Each raffle ticket costs 50p.
- She sells 400 tickets.
- The probability that a ticket, chosen at random, wins a prize is 0.1.
- Each winning ticket receives a prize worth £3.

Sophie says

> I expect the raffle to make over £100 profit.

Show that Sophie is wrong.

$400 \times 0.5 = £200$ ← earn

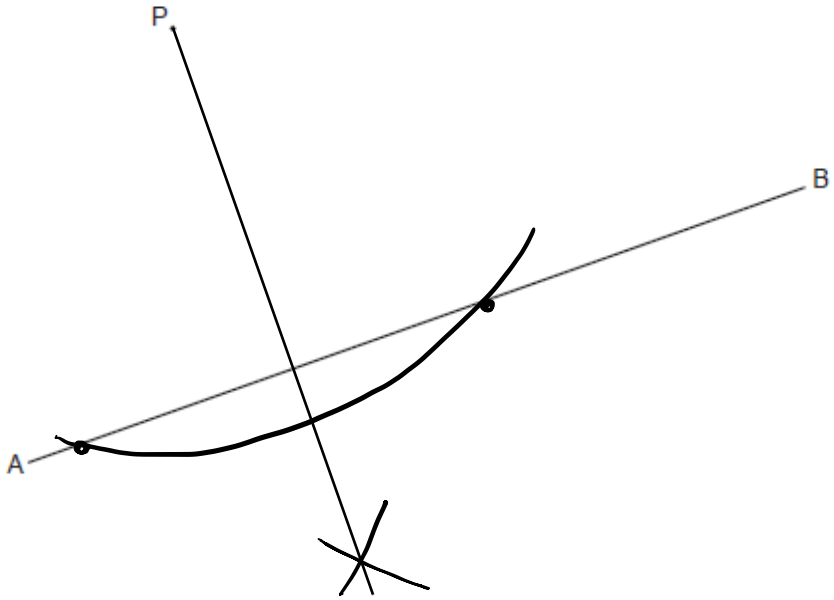
$400 \times 0.1 = 40$ winning tickets

$40 \times 3 = £120$ ← lost as prize money

$200 - 120 = £80 < £100$

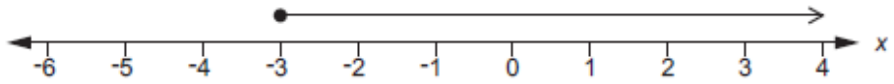
Sophie is expected to make a profit of £80 which is less than £100 [4]

3 Construct the perpendicular from the point P to the line AB.
Show all of your construction lines.



[2]

4 Martha's solution to the inequality $8x + 5 \leqslant 3x - 10$ is shown on the number line.

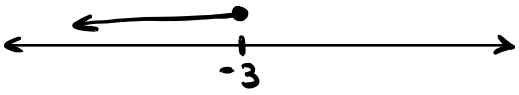


Is her solution correct?
Explain your reasoning.

$8x + 5 \leqslant 3x - 10$

$5x \leqslant -15$ $\div 5$

$x \leqslant -3$



No because from -3 the number goes smaller in the left direction not the right [4]

5 In 2017, the value of a house increased by 4%.
In 2018, the value of the house then decreased by 3%.

Teresa says

Over the two years the value of the house increased by exactly 1% because 4 – 3 = 1.

Show that Teresa is wrong.

2016 : value of house = x

2017 : $1.04x$

2018 : $0.97 \times 1.04x = 1.0088x$

Teresa is wrong because the value which 3% decreased from is different from original value.

Over two years, the value increased by 0.88 % [6]

6 **(a)** Antonio rolls two fair six-sided dice and calculates the **difference** between the scores.
For example, if the two scores are 2 and 5 or 5 and 2 then the difference is 3.

(a) Complete the sample space diagram to show the possible outcomes from Antonio's dice.

		Dice 2					
	difference	1	2	3	4	5	6
Dice 1	1	0	1	2	3	4	5
	2	1	0	1	2	3	4
	3	2	1	0	1	2	3
	4	3	2	1	0	1	2
	5	4	3	2	1	0	1
	6	5	4	3	2	1	0

[2]

(b) **(b)** Antonio rolls the two dice three times.

Calculate the probability that he gets a difference of 1 on all three rolls.
Give your answer as a fraction in its lowest terms.

$$\frac{10}{36} \times \frac{10}{36} \times \frac{10}{36} = \frac{125}{5832}$$

(b) $\frac{125}{5832}$ **[4]**

7 Prove that the mean of any four **consecutive** even integers is an integer. [4]

$x \quad x+2 \quad x+4 \quad x+6$

$$\frac{x + x+2 + x+4 + x+6}{4}$$

$$= \frac{4x + 12}{4}^{3}$$

$$= x + 3 = \text{mean}$$

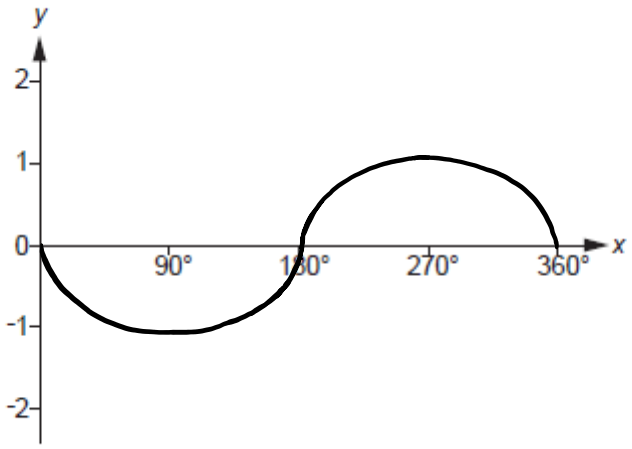
As x is an even integer and 3 is an integer, when two integers add together only integer is possible as the outcome

$2 \quad 4 \quad 6 \quad 8$

$$\frac{2+4+6+8}{4} = \frac{20}{4} = 5$$

eg. $x = 2 \quad x+3 = 2+3 = 5$

8 Sketch the graph of $y = -\sin x$ for $0° \leqslant x \leqslant 360°$.

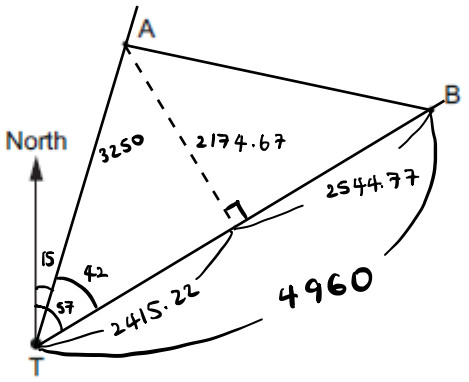


[3]

9 (a) T is a radar tower.
A and B are two aircraft.

At 3pm
- aircraft A is 3250 km from T on a bearing of 015°
- aircraft B is 4960 km from T on a bearing of 057°.

Not to scale



(a) Aircraft A flies directly towards radar tower T at a speed of 890 km/h.

At what time will the aircraft pass over radar tower T?
Give your answer to the nearest minute.

$\frac{3250}{890} = 3.6516...$ hrs

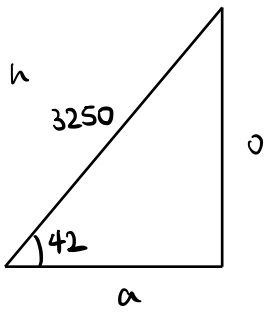
$0.6516... \times 60 = 39.101...$

3hrs and 39 minutes

3pm + 3hrs 39mins = 6 : 39 pm

(a) 6 : 39 pm ..... **[4]**

(b) Calculate the distance that was between aircraft A and aircraft B at 3pm.



$\sin 42 = \frac{o}{3250}$

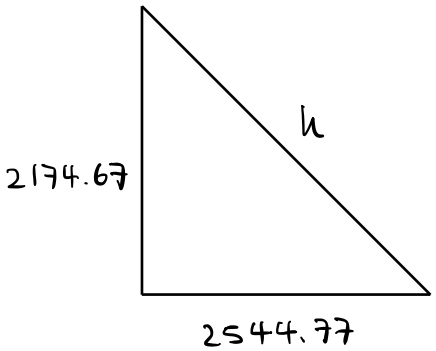
$o = 3250 \sin 42$

$o = 2174.67\ldots$

$\cos 42 = \frac{a}{3250}$

$a = 3250 \cos 42$

$a = 2415.22$



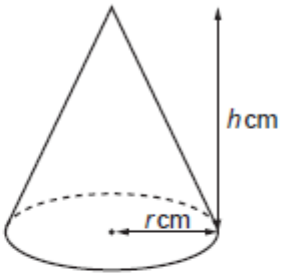
$h^2 = 2174.67^2 + 2544.77^2$

$h^2 = 11205091.38$

$h = 3347.40\ldots$

(b) 3347.40 km **[4]**

10 A cone has radius $r$cm and height $h$cm.



The height is three times the radius.
The volume of the cone is 2100 cm^3.

Calculate the radius of the cone.

[The volume V of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

$h = 3r$ $\quad V = \frac{1}{3}\pi r^2 h = 2100$ $\quad r = ?$

$\frac{1}{3}\pi r^2 \times 3r = 2100$

$\pi r^3 = 2100$

$r^3 = \frac{2100}{\pi}$

$r = \sqrt[3]{\frac{2100}{\pi}}$

$r = 8.7435\ldots$

8.74 ..... cm **[4]**

11 (a) The point (-5, 2) lies on the circumference of a circle, centre (0, 0).

(a) Find the equation of the circle.

$x^2 + y^2 = r^2 \leftarrow x = -5, y = 2$

$(-5)^2 + 2^2 = r^2$

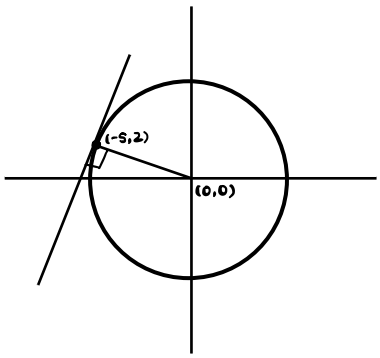
$25 + 4 = r^2$

$29 = r^2$

$x^2 + y^2 = 29$

(a) $x^2 + y^2 = 29$ [4]

(b) **(b)** Work out the gradient of the tangent to the circle at (-5, 2).



gradient of radius: $\frac{\Delta y}{\Delta x} = G$

$\frac{2-0}{-5-0} = -\frac{2}{5}$

since perpendicular with radius...
tangent gradient is $\frac{5}{2}$

$(m \rightarrow -\frac{1}{m})$

(b) $\frac{5}{2}$ [2]

Total Marks for Question Set 1: 50