2019 Junior Certificate Higher Level Paper Two

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1. (a) The range of data is the difference between the smallest and largest values.

$$172 - 141 = 31$$

(b) An outlier is a piece of data which 'stands out' for being different. Usually a value much larger or smaller than the rest.

$$141 \text{ is much smaller than the rest}$$

(c) The mean is what we generally consider as the 'average' of the data.

$$\frac{141 + 165 + 167 + 168 + 169 + 170 + 172 + 172}{8} = 165.5cm$$

(d) For most of the teachers to be taller than 175cm, then the median height must be 175cm or greater.

2. (a) Categorical Nominal

   (b) Car

(c)

| | 2006 | | 2016 | |
way of travelling	men	women	men	women
walk or cycle	12.1	15.4	12.2	12.6
bus or train	8.0	11.3	8.3	10.5
car	62.6	71.4	60.0	71.9
other	15.3	0.7	14.2	0.4
not stated	2	1.2	5.3	4.6
Total	100.0	100.0	100.0	100.0

   (d)
$$15.4 > 12.1$$

   (e) Alison is incorrect. If more women were surveyed in 2006, even a larger percentage in 2016 could repersent a smaller amount.

   (f)

$$990000 * 8.3\% + 880000 * 10.5\% = 174570 \text{ people who travelled to work by bus or train}$$

$$\frac{174570}{990000 + 880000} * \frac{100}{1} = 9.34\%$$

   (g) i.

way of travelling	walk or cycle	bus or train	car	other	not stated
% of men in 2016	12.2	8.3	60.0	14.2	5.3
Angle in pie chart	44	30	216	51	19

$$360 * 12.2\% = 44$$
$$360 * 8.3\% = 30$$
$$360 * 60\% = 216$$
$$360 * 14.2\% = 51$$
$$360 * 5.3\% = 19$$

       ii. TODO

   (h) The amount of students travelling to school by foot or bicycle saw a large decline between 1986 and 2002, from about 50% to 28% but has remained steady since. The amount of travelling by car showed the opposite, a large increase, starting at 25% and ending at close to 60%. The amount of students taking the bus or train shows a much less aggresive decline since 1986.

3.

Transformation	Image
Axial Symmetry in the x-axis	S
Axial Symmetry in the y-axis	T
Translation	P
Central symmetry in the origin	Q

4. (a) TODO

   (b) TODO

5. (a)

$$\text{Shop } (-3, 1)$$
$$\text{Home } (4, 2)$$
$$\text{School } (4, 5)$$

(b) Use the midpoint formula to find the midpoint of 2 points, (x1, y1) and (x2, y2).

$$Home = (4, 2) = (x_1, y_1)$$
$$Shop = (-3, 1) = (x_2, y_2)$$
$$midpoint = (\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$$
$$= (\frac{4 + -3}{2}, \frac{2 + 1}{2})$$
$$= (\frac{1}{2}, \frac{3}{2})$$
$$= (0.5, 1.5)$$

(c) Use the distance formula to find the distance between 2 points, (x1, y1) and (x2, y2).

$$Home = (4, 2) = (x_1, y_1)$$
$$Shop = (-3, 1) = (x_2, y_2)$$
$$distance = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$
$$= \sqrt{(4 - -3)^2 + (2 - 1)^2}$$
$$= \sqrt{(7)^2 + (1)^2}$$
$$= \sqrt{49 + 1}$$
$$= \sqrt{50}$$
$$= 7.07$$

(d)

$$\text{1 unit on diagram} = 2500 \text{ units in real life.}$$
$$\text{8.1 cm on diagram} = 2500\text{*}8.1\text{cm in real life}$$
$$= 20250cm$$
$$= 202.5m$$

(e) It is very unlikely she walks an exact straight line between the shop and the school. Any deviation from the straight line willl result in a larger distance.

(f) Use the slope formula to find the slope between 2 points, (x1, y1) and (x2, y2).

$$Shop = (-3, 1) = (x_1, y_1)$$
$$School = (4, 5) = (x_2, y_2)$$
$$slope = (\frac{y_2 - y_1}{x_2 - x_1})$$
$$= (\frac{5 - 1}{4 - -3})$$
$$= (\frac{4}{7})$$

(g) Use the equation of a line formula with slope m and any point (x1, y1).

$$slope = m = \frac{4}{7}$$
$$point = (x_1, y_1) = (4, 5)$$
$$y - y_1 = m(x - x_1)$$
$$y - 5 = \frac{4}{7}(x - 4)$$
$$7y - 35 = 4x - 16$$
$$4x - 7y + 19 = 0$$

(h) If we make a triangle with

$$tan(l) = \frac{4}{7}$$
$$tan^{-1}(\frac{4}{7}) = l$$
$$29.7\ degrees = l$$

6. (a)

Type of angle	Acute	Reflex	Obtuse
Angle	K	N	M

(b)

$K = 60$ degrees, it's an equilateral

$M = 120$ degrees, because K+M=180 degress (straight line)

$N = 240$ degrees, 360(full circle) - 60 - 60 = 240

(c)   i. The 2 trianlges are similar because their angles are the same (60 degrees).

   ii. The 2 trianlges are not congruent because their sides are not the ame length.

(d) TODO

7. (a)

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Diagram A

$4 + 10 + \text{3rd side} = 26$

$\text{3rd side} = 26 - 4 - 10$

$= 12$

Diagram B

$9 + 10 + \text{3rd side} = 26$

$\text{3rd side} = 26 - 9 - 10$

$= 7$

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(b)

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4 or 9 or 10

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(c)   i.

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$19cm^2$

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  ii.

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TODO

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  iii. TODO

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$x = 8$

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(d) Disprove pythagoras theorem.

$$a^2 + b^2 \neq c^2$$
$$5^2 + 10^2 \neq 11^2$$
$$25 + 100 \neq 121$$

(e) Construct a perpendicular line from the bottom side to the top angle in order to find the height of the triangle. Then use the area of a triangle formula.

$$height = \sqrt{8^2 - 5^2}$$
$$= \sqrt{64 - 25}$$
$$= \sqrt{39}$$

$$Area = \frac{1}{2} * base * height$$
$$= \frac{1}{2} * 10 * \sqrt{39}$$
$$= 5\sqrt{39}$$

8. (a) 1

   (b) Roll a 7 or an 8, representing 2 out of 6 possible outcomes.

$$P(\text{greater than } 6) = \frac{2}{6}$$
$$= \frac{1}{3}$$

   (c) First find the probability of rolling an odd number in 1 roll. 4 out of 6 possible outcomes are odd.

$$P(\text{odd}) = \frac{4}{6}$$
$$= \frac{2}{3}$$

   Then multiple this probability by the number of rolls.

$$60 * \frac{2}{3} = 40$$

   (d)

Description	Term
The set of all possible outcomes of an experiment	Sample Space
One possible result of an experiement	Outcome
A subset of the sample space - a collection of one or more outcomes	Event

H, HHH, 3

T, HHT, 2

H, HTH, 2

T, HTT, 1

H, THH, 2

T, THT, 1

H, TTH, 1

T, TTT, 0

H

H

T

T

H

T

H

T
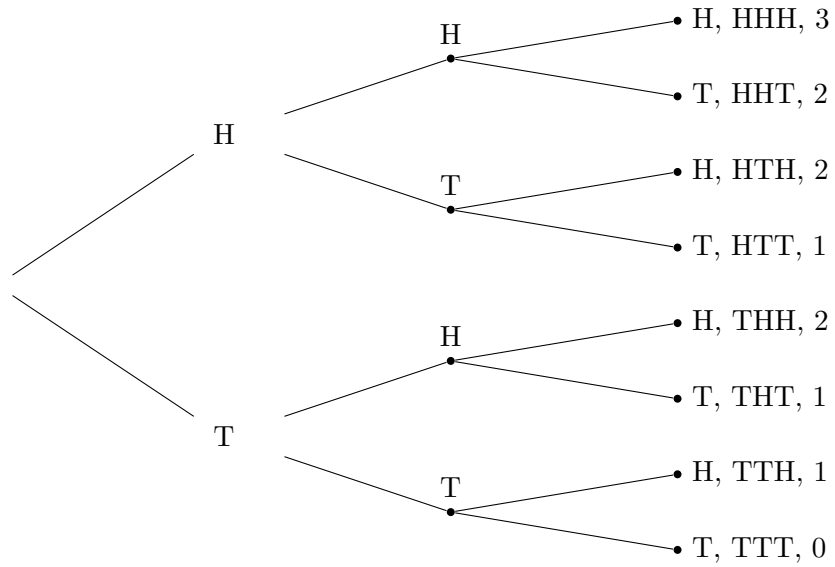
9. (a) (i), (ii), (iii)

(b)

Number of Heads (H)	0	1	2	3
Probability	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

(c) i. To flip no heads after 8 coin flips is very unlikely. The can only happen in the event that she flips all tails.

$$1$$

ii. There are 8 outcomes with exactly 1 head. A head on the first flip only, or a tail on the second flip only or the thirs flip only, and so on.

$$8$$

(d)

$$2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 = 2^8 = 256$$

10. (a) Use the circumference of a circle formula.

$$C = 2\pi r = \pi d$$
$$= \pi(8)$$
$$= 25.1$$

(b) The rubber track goes around the circumference of a semi-circle on both ends, and over 3 diameters of the circle on the top and the bottom.

$$length = (semicircle) + (semicircle) + (top\ straight) + (bottom\ straight)$$
$$= (\pi r) + (\pi r) + (3d) + 3d)$$
$$= 2(\pi r) + (6d)$$
$$= 25.1 + 48$$
$$= 73.1$$

(c) We need to divide the total length of track by the length of circumference of one wheel.

$$turns = \frac{length\ of\ track}{circumference\ of\ wheel}$$
$$= \frac{73.1}{25.1}$$
$$= 2.9124$$
$$= 2\ full\ turns$$

11. Divide the shape into 2 smaller rectangles. The smaller one on the left having dimensions s and 6-s. And the larger right one having dimensions 6 and 10-s.

(a)

$$Area_{\ total} = Area_{\ smaller} + Area_{\ bigger}$$
$$= (s)(6-s) + (6)(10-s)$$
$$= (6s - s^2) + (60 - 6s)$$
$$= 60 - s^2$$

(b)

$$Perimeter = 10 + 6 + (10-s) + (6-s) + s + s$$
$$= 10 + 10 + 6 + 6$$
$$= 32, \text{ since the s's cancel, the value doesn't matter}$$

12. (a) TODO

13. (a)

$$sin(20) = \frac{6}{x}$$
$$(x)sin(20) = 6$$
$$x = \frac{6}{sin(20)}$$
$$= 17.54$$

(b)

$$cos(Y) = \frac{a}{c}$$
$$sin(Y) = \frac{b}{c}$$
$$cos(Y) + sin(Y) = \frac{a}{c} + \frac{b}{c}$$
$$= \frac{a+b}{c}$$
$$if \ a+b > c, \ then \ \frac{a+b}{c} > 1, \text{ since numerator} > \text{denominator}$$

14.

$$V_{cylinder} = \pi r^2 h = \pi r^2 10 = 10\pi r^2$$

$$V_{cone} = \pi r^2 \frac{h}{3}$$

$$V_{cone} = V_{cylinder} * 90\%$$

$$\pi r^2 \frac{h}{3} = 10\pi r^2 * 90\%$$

$$\pi r^2 \frac{h}{3} = 9\pi r^2$$

$$r^2 \frac{h}{3} = 9r^2$$

$$\frac{h}{3} = 9$$

$$h = 27$$

$$increase = \frac{new\ height - old\ height}{old\ height}$$

$$= \frac{27 - 10}{10}$$

$$= \frac{17}{10}$$

$$= 170\%\ increase$$