(a) (i) Slope of AC

Use slope formula: $\frac{y_2-y_1}{x_2 x_1} \rightarrow \frac{3-0}{0-(-2)} = \frac{3}{2}$

(ii) AC is not perpendicular to BC

Slope of BC

Use slope formula: $\frac{y_2-y_1}{x_2 x_1} \rightarrow \frac{3-0}{0-5} = -\frac{3}{5}$

Perpendicular slopes: $m_1 \times m_2 = -1$

$\frac{3}{2} \times -\frac{3}{5} \neq -1$ therefore not perpendicular

(b) (i) Distance from M to x-axis $= 9$

Distance from L to x-axis is the same as symmetrical

Therefore $|\text{LM}| = 9 + 9 = 18$

(ii) $y = 1$ (no slope)

(iii) Point N is where the line NM hits the y-axis

Crosses the y-axis when $x = 0$

$(0) + 4y - 13 = 0$

$4y = 13$

$y = \frac{13}{4}$

$\left(0\,,\frac{13}{4}\right)$

(a) (i) Centre: $(4\,,-2)$

Radius: $\sqrt{169} = 13$

(ii) If the point is inside the circle, it cannot be more than 13 units away from the centre, therefore

find the distance from the centre $(4\,,-2)$ to the point $(11, 10)$

Distance of the line formula: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$\sqrt{(11-4)^2 + (10-(-2))^2} = \sqrt{49+144} = \sqrt{193} = 13.89$

$13.89 > 13$

Therefore point is outside of circle k

(b) (i) Change in x and y values is the same from point $(12\,,11)$ to point $(22\,,13)$ as from point $(22\,,13)$

to the other point on circle s

x change: $+10$, y change: $+2$

$(22+10\,,13+2)$

$(32\,,15)$

(ii) Use the change in x and y values from part (i), half the change and use them in reverse

x change: $+\frac{10}{2}$, y change: $+\frac{2}{2}$

x change: -5 , y change: -1 (in reverse)

$(12-5\,,11-1)$

$(7\,,10)$

(a) (i) $\frac{17+8+9+8+14+11+28}{7} = \frac{95}{7} = 13.6$

(ii) $8, 8, 9, 11, 14, 17, 28$

Median: 11 (4^{th} term)

(iii) There are 9 numbers in the list, therefore the median will be the average of the 4^{th} and 5^{th} number

The median has decreased, therefore the number is smaller than the previous median

$8, 8, 9, x, 11, 14, 17, 28$

$\frac{x+11}{2} = 10.5$

$x + 11 = 21$

$x = 10$

(b) (i) $3 \times 4 \times 5 = 60$

(ii) Answer: Group A

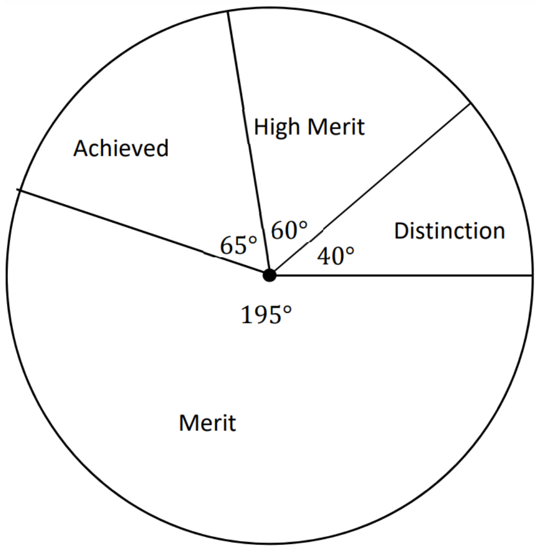
Justification:

A increase: $(3 + 1) \times 4 \times 5 = 80$

B increase: $3 \times (4 + 1) \times 5 = 75$

C increase: $3 \times 4 \times (5 + 1) = 72$

(a)



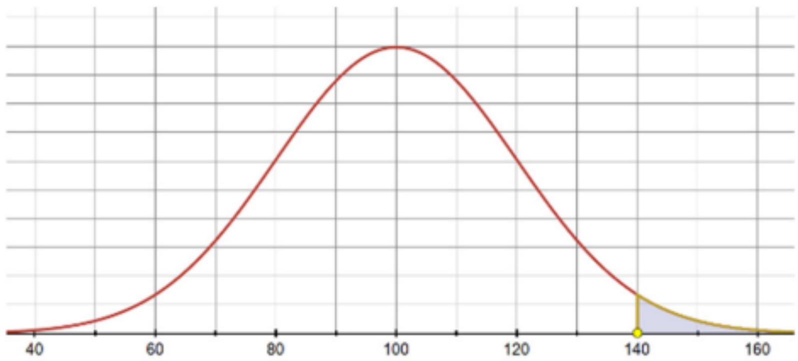
$8 + 12 + 39 + 13 = 72$

$\frac{360}{72} = 5°$ per person

E.g. Distinction: $5 \times 8 = 40°$

(b) (i) 68%

(ii) $100 + 2(20) = 140$



(c) Range: $[82\,,113] \rightarrow \quad 113 - 82 = 31$

Standard deviation: $9.758 = 9.8$

(a) (i) $\frac{180}{3} = 60°$

(ii) $\frac{1}{2}abSinC$

$\frac{1}{2}(8)(8)Sin(60) = 16\sqrt{3}$ cm^2

(iii) Use Pythagoras and half the base: $a^2 + b^2 = c^2$

$4^2 + x^2 = 8^2$

$x^2 = 64 - 16$

$x^2 = 48$

$4\sqrt{3}$ cm

(b) Pythagoras Theorem: $a^2 + b^2 = c^2$

$12^2 + y^2 = 30^2$

$y^2 = 30^2 - 12^2$

$y^2 = 900 - 144$

$y = \sqrt{756} = 6\sqrt{21} = 27.5$ cm

(a) (i) $90°$ (as angle on an arc)

(ii) Angle ODB $=$ Angle OBD as line OD and line OB are equal as both are radius.

Angle BOD: $180 - 130 = 50°$

Angle X (ODB): $\frac{180-50}{2} = 65°$

(iii) $\frac{\theta}{360} \times 2\pi r \rightarrow \frac{130}{360} \times 2\pi(18) = 13\pi$ cm

Or the outer arc: $\frac{\theta}{360} \times 2\pi r \rightarrow \frac{360-130}{360} \times 2\pi(18) = 23\pi$ cm

(b) (i) False

Similar Triangles have the same shape but different measurements, thus a small and a large triangle could have angles the same but they are not identical.

(ii) True

Congruent Triangles are triangles where all the corresponding sides and interior angles are equal in measure (including area).This means all features are identical so angles must be the same.

(a) (i)

Day X						Day Y		
		9	5	4	8			
7	5	3	3	5	4	5		
		9	7	6	0	1	3	
		4	3	7	0	6	9	
				8	1			

Key:
6 | 0 = 6·0 kg

(ii) That the weight of the dogs has increased from Day X to Day Y

(iii) 0.9

There's a strong positive linear relationship

(b)

	Male	Female	Total
Cats	5	9	14
Dogs	11	15	26
Total	16	24	40

(c) (i) Probability of a cat: $\frac{14}{40}$

(ii) $\frac{11}{40} \times \frac{10}{39} \times \frac{9}{38} = 0.017$

(d) $9! = 362{,}880$

(e) $40 - 10 = 30$

How many of these 30 are dogs: $30 \times \frac{11}{15} = 22$

Remainder are cats: $30 - 22 = 8$ cats remaining

Therefore number of cats who left the shelter during the week: $14 - 8 = 6$

(a) (i) $\frac{1}{2}\left(\frac{4}{3}\pi r^3\right) \rightarrow \frac{2}{3}\pi(3)^3 = 18\pi$ m^3

(ii) Volume of a cylinder: $\pi r^2 h$

$\pi(3)^2 h = 36\pi$

$9h = 36$

$h = 4$ m

(b) (i) $TanA = \frac{opposite}{adjacent}$

$TanA = \frac{47}{7.5}$

$A = Tan^{-1}\left(\frac{47}{7.5}\right) = 80.9335$

$A = 81°$

(ii) $TanA = \frac{opposite}{adjacent}$

$Tan81 = \frac{x}{3}$

$x = 3Tan81 = 18.94$

$47 - 18.94 = 28.06$ m

(c) (i) Area of a circle: $\pi r^2 \rightarrow \pi(50)^2 = 7{,}854$ km^2

(ii) $\frac{50}{27} = 1.852$ km

(d) $tanX = \frac{opposite}{adjacent}$

$tan1.2 = \frac{49}{d}$

$d(tan1.2) = 49$

$d = \frac{49}{tan1.2} = 2{,}339.2$ m

$d = 2.34$ km

(a) 5 times

Possible height: $\frac{8.5}{5} = 1.7$ m

(b) Upper triangle area: $\frac{1}{2}(base)(height) \rightarrow \frac{1}{2}(12)(8.5 - 7) = 9$

Volume of upper triangle: $9 \times 18 = 162$

Volume of cuboid: $l \times w \times h \rightarrow 7 \times 12 \times 18 = 1512$

$1512 + 162 = 1674$ m^3

$1{,}674{,}000l > 1{,}000{,}000l$

Therefore Seán's statement is correct

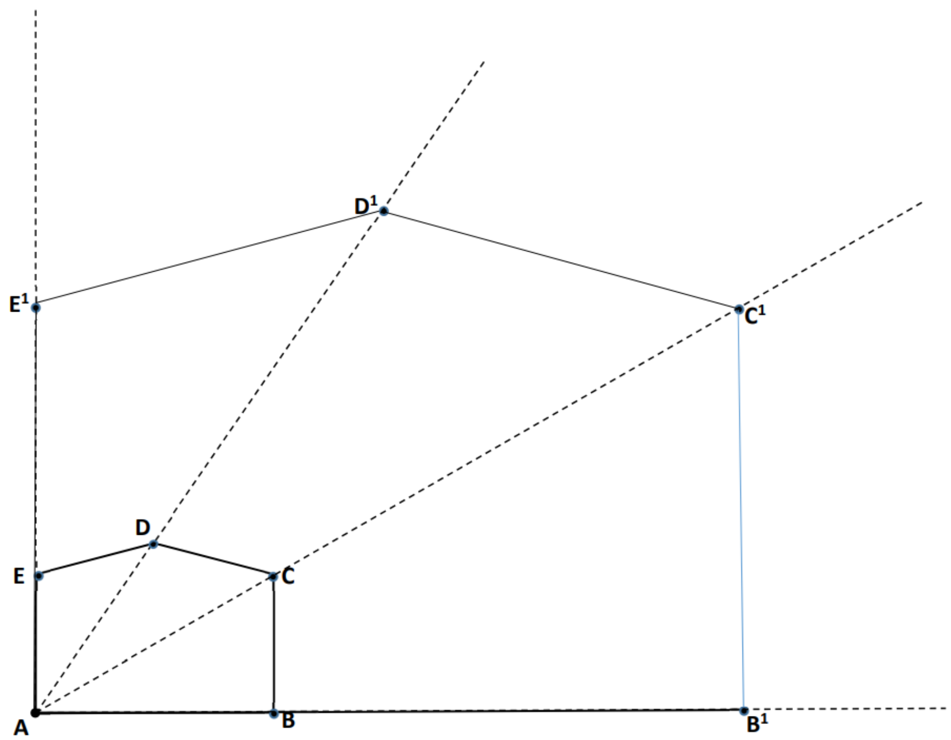
(c) Pythagoras Theorem: $a^2 + b^2 = c^2$

$6^2 + 1.5^2 = d^2$

$d^2 = 36 + 2.25$

$d = \sqrt{38.25} = 6.2$ m

(d)



(e) (i) Cosine rule: $a^2 = b^2 + c^2 - 2bcCosA$

$x^2 = 3^2 + 7^2 - 2(3)(7)Cos30$

$x^2 = 9 + 49 - 42Cos30$

$x^2 = 21.6269$

$x = 4.65$

(ii) Sine rule: $\frac{SinA}{a} = \frac{SinB}{b}$

$\frac{Sin30}{4.65} = \frac{SinC}{3}$

$SinC = \frac{3Sin30}{4.65}$

$C = sin^{-1}\left(\frac{3Sin30}{4.65}\right) = 19°$

(a) Advantage: more practical

Disadvantage: not as accurate

(b) (i) Margin of error: $\frac{1}{\sqrt{n}} \quad \rightarrow \quad \frac{1}{\sqrt{1500}} = 0.0258$

(as a percentage): $0.0258 \times 100 = 2.6\%$

(ii) $1500 \times 0.71 = 1{,}065$

(iii) 71 ± 2.6

$68.4 \leq p \leq 73.6$

(iv) $H_0 = 65\%$

$H_A \neq 65\%$

Conclusion: Reject the null hypothesis (H_0) and conclude that the figure of 65% has changed in 2022.

Reason: The figure of 65% is outside the 95% confidence interval.

(c) $\binom{3}{1}(0.2)^1(0.8)^2 = 0.384$

(d) Expected value

$0.3 \times €0 = €0$

$0.6 \times (52 \times €6) = €187.2$

$0.1 \times (104 \times €6) = €62.4$

$0 + 187.2 + 62.4 = €249.6$

(e) $420 + 6n = 670$

$6n = 250$

$n = \frac{250}{6} = 41.67$ (Round up as it is the least value to get over the €670 threshold)

$n = 42$