

Section I

1	2	3	4	5	6	7	8
A	C	A	D	B	B	D	C

9	10	11	12	13	14	15	16
A	D	B	A	C	B	B	D

17	18	19	20	21	22		
A	A	B	D	B	C		

Q1 $12k^3 \div 4k = \frac{12k^3}{4k} = 3k^{3-1} = 3k^2$ A

Q2 Surface area = $(2 \times 5) \times 1 + (3 \times 5) \times 2 + (3 \times 2) \times 2 = 52 \text{ cm}^2$ C

Q3 Range = Max - min = $67 - x = 43$, $x = 24$, $\therefore N = 4$ A

Q4 $y = 3^x$ is an exponential function. $y = 1$ when $x = 0$. D

Q5 The smallest angle (let it be θ) is opposite to the shortest side of the triangle.

Use the cosine rule: $6^2 = 7^2 + 8^2 - 2(7)(8)\cos\theta$,

$\cos\theta = \frac{7^2 + 8^2 - 6^2}{2(7)(8)}$, $\theta \approx 47^\circ$ B

Q6 $30001 < 43561 < 45000$

Tax payable = $5400 + (43561 - 30000) \times 0.40 = 10824.40$ B

Q7 Last week pay = $15 \times 12 \times 1.5 = 270$

This week pay = $15 \times x \times 2 = 270$, $\therefore 30x = 270$, $x = 9$ D

Q8 When the 33 scores are in order, the median is the 17th score, i.e. 14. C

Q9 $\sqrt{\frac{x+2y}{8y}} = \sqrt{\frac{5.6+2 \times 3.1}{8 \times 3.1}} \approx 0.69$ A

Q10 The boxes have the same width, \therefore the two sets of data have the same interquartile range. D

Q11 Area of the shower floor (excluding the drain)
= $100 \times 100 - \pi \times 5^2 \approx 9921 \text{ cm}^2$ B

Q12 The word 'skewed' is used to describe the distribution of a set of data, not the correlation between two sets of data. A

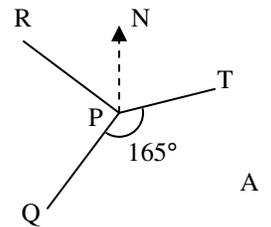
Q13 The average height of the two students must be 160 cm as well. $(149 + 171) \div 2 = 160$ C

Q14 $\frac{h}{80} = \sin 55^\circ$, $h = 80 \sin 55^\circ \approx 66 \text{ m}$ B

Q15 Total amount paid on terms
= $15\% \text{ of } 16000 + 320 \times 60 = 21600$
Interest = $21600 - 16000 = \$5600$ B

Q16 $\Pr(\text{blue}) = \frac{3}{8} = \frac{6}{16}$, i.e. 6 blue marbles out of a total of 16 marbles. D

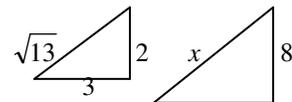
Q17
Q is SW of P and R is NW of P,
 $\therefore \angle RPQ = 90^\circ$ and $\angle RPN = 45^\circ$.
 $\therefore \angle NPT = 360^\circ - 45^\circ - 90^\circ - 165^\circ = 60^\circ$



Q18 $M(\text{letter})(\text{numeral})(\text{numeral})(\text{letter})(\text{letter})$
 $1 \times 26 \times 10 \times 10 \times 26 \times 26 = 26^3 \times 10^2$ A

Q19 Since $h \propto \sqrt{n}$, $\therefore \frac{h_b}{h_a} = \frac{\sqrt{n_b}}{\sqrt{n_a}} = \sqrt{\frac{n_b}{n_a}}$,
 $\therefore \frac{h_b}{35} = \sqrt{\frac{10000}{2000}} = \sqrt{5}$, $\therefore h_b = 35\sqrt{5} \approx 78$ B

Q20 Similar triangles:



$\frac{x}{8} = \frac{\sqrt{13}}{2}$, $x = 4\sqrt{13} \approx 14.42 \text{ m}$ D

Q21 $V_{\text{cylinder}} : V_{\text{sphere}}$
= $\pi r^2 h : \frac{4}{3} \pi r^3 = \pi r^2 (4r) : \frac{4}{3} \pi r^3 = 4\pi r^3 : \frac{4}{3} \pi r^3 = 1 : \frac{1}{3} = 3 : 1$ B

Q22 $\Pr(6) = \frac{450}{1200} = \frac{3}{8}$, $\therefore \Pr(6') = 1 - \frac{3}{8} = \frac{5}{8}$,
 $\therefore \Pr(1) = \Pr(2) = \Pr(3) = \Pr(4) = \Pr(5) = \frac{5}{8} \div 5 = \frac{1}{8}$ C

Section II

Q23ai Feb, Mar, Nov or Dec.

Q23aii In the 4 months in Q23ai, only Nov has average rainfall less than 80 mm. ∴ Nov is the best month if both rainfall and temperature data are considered.

Q23bi Capacity = 1250 ml, correct to the nearest 10 ml.
∴ the capacity is between 1245 and 1254.999... ml,
i.e. 1250 ± 5 ml.

∴ percentage error = $\frac{5}{1250} \times 100\% = 0.4\%$.

Q23ci Volume of alcohol = 5.5% of 375 ml
= $\frac{5.5}{100} \times 375 = 20.625$ ml.

Q23cii Rate of alcoholic drink intake
= 1 standard drink per hour
= $\frac{375}{1.6}$ ml per hour
= $\frac{375}{1.6} \div 60$ ml per minute ≈ 3.9 ml per minute.

Q23d $\frac{5x+1}{2} = 4x-7$, $5x+1 = 2(4x-7)$, $5x+1 = 8x-14$,
 $15 = 3x$, $x = 5$.

Q23e Length of bar graph = 9 cm,
length of pizza section = 3.5 cm.
Number of people = $\frac{3.5}{9} \times 450 = 175$.

Q23f Mean mark for 4 tests
= (total mark for the first 3 tests + mark, x , for the 4th test) $\div 4$
i.e. $73 = \frac{72 \times 3 + x}{4}$, ∴ $x = 76$.

Q24ai Total sales in a year = $\$15670 \times 12 = \188040
Earning per year = 13% of $\$188040 = \24445.20

Q24aii Bob should choose Method 2.
Earning per year = $\$350 \times 52 + 4.5\% \text{ of } \$188040 = \$26661.80$

Q24bi Number of 3-digit numbers = $3 \times 4 \times 5 = 60$.

Q24bii Number of odd ones = $3 \times 4 \times 3 = 36$,
∴ $\Pr(\text{odd}) = \frac{36}{60} = \frac{3}{5}$.

Q24biii Number of even ones = $60 - 36 = 24$.

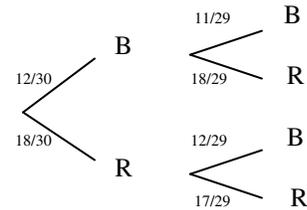
Q24biv 432, 431, 421 and 321 are the only possibilities satisfying the requirements. Probability = $\frac{4}{60} = \frac{1}{15}$.

Q24c $A = N(1+r)^n$, where $A = 740000$, $r = \frac{2}{100} = 0.02$ and
 $n = 40$. ∴ $740000 = N(1.02)^{40}$, ∴ $N = \frac{740000}{1.02^{40}} = \335138.91 .

Q25ai $a \times 2^t = P$, $a \times 2^2 = 24$, ∴ $a = 6$.

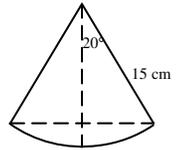
Q25aii $6 \times 2^t = 1500$, $2^t = 250$, $t = \frac{\log(250)}{\log(2)} \approx 7.966$.
∴ it will take 8 years to first exceed 1500.

Q25bi



Q25bii $\Pr(\text{same colour}) = \Pr(BB \text{ or } RR)$
= $\Pr(BB) + \Pr(RR) = \frac{12}{30} \times \frac{11}{29} + \frac{18}{30} \times \frac{17}{29} = \frac{73}{145}$.

Q25ci Height of box = radius = 15 cm
Width of box = $7 \times 3 = 21$ cm
Length of box = $(15 \sin 20^\circ) \times 8 = 41.04$ cm



Q25cii Cross-sectional area of triangular prism
= $\frac{1}{2} \times 15 \times 15 \times \sin 40^\circ = 72.314$ cm²
Volume of triangular prism = $72.314 \times 7 \approx 506$ cm³

Q26ai

	Aged < 40	Aged ≥ 40	Total
Liked (L)	65	37	102
Did not like (L')	42	31	73
Total	107	A	175

$A = 37 + 31 = 68$.

Q26aii $\Pr(< 40 \cap L') = \frac{42}{175} = \frac{6}{25}$.

Q26aiii $\Pr(L) = \frac{102}{175}$, percentage = $\frac{102}{175} \times 100\% = 58.3\%$. No.

Q26bi Relative frequency = $\frac{35000}{2000000} = 0.0175$

Q26bii The distribution is negatively skewed with 80% of the retirement ages between 61 and 75.

Q26ci The chance for outcome 4 to occur
 $= (100 - 10 - 40 - 30)\% = 20\%$.

Let \$x be the loss in outcome 4.

Expectation of the game = 0,

$$\therefore 10\% \times 12 + 40\% \times 6 + 30\% \times 3 - 20\% \times x = 0, \therefore x = 22.50.$$

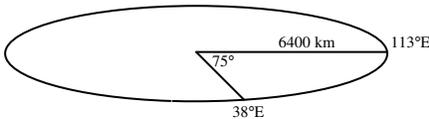
Q26di From graph, $0.6M = 0.6 \times 1000000 = 600000$

Q26dii The modal age group is 35-39.

Q26diii Number of males + number of females
 $= 0.7M + 0.7M = 1.4M$

Q26div The 80+ age group has a greater range in age whilst the 75-79 age group has only a range of 5 years.

Q27ai



$$\theta^\circ = 113^\circ - 38^\circ = 75^\circ.$$

$$\text{Distance} = \frac{\pi}{180^\circ} r \theta^\circ = \frac{\pi}{180^\circ} \times 6400 \times 75^\circ \approx 8378 \text{ km.}$$

Q27aii Time taken = $\frac{d}{v} = \frac{8378}{913} \approx 9$ hours.

Q27aiii Borneo is ahead of Kenya by $\frac{75}{360} \times 24 = 5$ hours.

Kenya time: Departure 10pm Tue; 9 hrs later, arrival 7am Wed.

Borneo time: Departure 3am Wed; arrival 12 noon Wed.

Q27bi Use $N = M \left\{ \frac{(1+r)^n - 1}{r(1+r)^n} \right\}$,

where $n = 12 \times 30 = 360$, $r = \frac{8.25}{100 \times 12} = 0.006875$, $N = 290000$
 and M is the monthly repayment.

$$\therefore 290000 = M \left\{ \frac{(1+0.006875)^{360} - 1}{0.006875(1+0.006875)^{360}} \right\}. \therefore M \approx \$2178.67.$$

Q27bii Total amount paid = $2178.67 \times 360 = \$784321.20$.

Q27biii $N = 290000$, $r = 0.006875$.

The monthly repayment is increased by \$250,

$$\therefore M = 2178.67 + 250 = 2428.67.$$

$$\therefore 290000 = 2428.67 \left\{ \frac{(1+0.006875)^n - 1}{0.006875(1+0.006875)^n} \right\},$$

$$119.4069182 = \frac{1.006875^n - 1}{0.006875 \times 1.006875^n},$$

$$0.8209225626 \times 1.006875^n = 1.006875^n - 1,$$

$$0.1790774374 \times 1.006875^n = 1, \therefore 1.006875^n = 5.584176402,$$

$$n = \frac{\log(5.584176402)}{\log(1.006875)} = 251.032 \text{ months.}$$

Time required to pay off the loan is $\frac{251.032}{12} = 20.92$ years.

Unable to pay off in 20 years.

Q27c Use $S = V_0(1-r)^n$, where $S = 2023$, $n = 2$ and

$$r = \frac{15}{100} = 0.15.$$

$$\therefore 2023 = V_0(1-0.15)^2, 2023 = V_0 \times 0.85^2, \therefore V_0 = \$2800.$$

Q28ai For 6-year old girl of height 120 cm, $z = 1$.

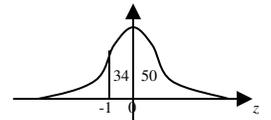
Q28aii1 If 2.5% of girls are taller than Rachel, Rachel's height must be $\mu + 2\sigma$, $\therefore z = 2$ and Rachel's height is 155 cm.

Q28aii2 At age $15\frac{1}{2}$, Rachel remains 155 cm tall and this

corresponds to $z = -1$.

Percentage of girls taller than Rachel

$$= 34\% + 50\% = 84\%.$$



Q28aiii For 18-year old girls, average height (corresponds to $z = 0$) is 163 cm.

$$\text{Q28aiv } 21 \leq B \leq 25, 21 \leq \frac{m}{h^2} \leq 25, 21 \leq \frac{m}{1.63^2} \leq 25,$$

$$\therefore 21 \times 1.63^2 \leq m \leq 25 \times 1.63^2, \text{ i.e. } 55.8 \leq m \leq 66.4.$$

Minimum weight is 55.8 kg.

Q28av1 The average height of a girl between 6 and 11 years increases by 6 cm per year.

Q28av2 The given graphs are linear between 6 and 11 years, but not for age older than 12.

Q28bi Simpson's rule: $A = \frac{h}{3}(d_f + 4d_m + d_l)$.

$$A \text{ (2 applications)} = \frac{h}{3}(0 + 4a + b) + \frac{h}{3}(b + 4a + 0) = \frac{2h}{3}(4a + b).$$

Q28bii $A = 600$, $4h = 80$, $\therefore h = 20$.

$$\therefore 600 = \frac{2 \times 20}{3}(4a + b), \therefore 4a + b = 45, \therefore b = 45 - 4a.$$

If a increases by 2 m, b decreases by 8 m.

Please inform mathline@itute.com re conceptual, mathematical and/or typing errors.