S1 Revision Clock answers

1. (a) To simplify a real world problem
To improve understanding / describe / analyse a real world problem
Quicker and cheaper than using real thing
To predict possible future outcomes
Refine model / change parameters possible — Any 2 — B1 B1 — 2

(b) (i) e.g.s height, weight — B1

(ii) score on a face after tossing a fair die — B1 — 2

[4]

2.

	1	2	2	3	3	3
1	2	3	3	4	4	4
2	3	4	4	5	5	5
2	3	4	4	5	5	5
3	4	5	5	6	6	6
3	4	5	5	6	6	6
3	4	5	5	6	6	6

$2 \times (1, 2, \ldots, 3)$ — M1

Adding — M1

All ≥ 5 correctly indicated — A1

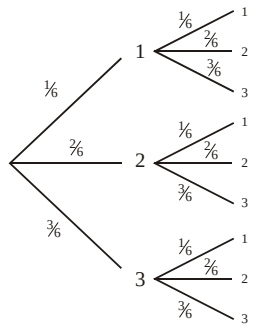
$\therefore$ P (sum at least 5) = $\frac{21}{36} = \frac{7}{12}$

Attempt to count ≥ 5 — M1

$\frac{21}{36}$; $\frac{7}{12}$; $0.58\dot{3}$; *0.583* — A1 — 5

[5]

Alt 1



Tree with relevant branches — M1

All correct – $\frac{2}{6}$, $\frac{3}{6}$ on those branches — A1

P(sum ≥ 5) = $\left(\frac{2}{6} \times \frac{3}{6}\right) + \left(\frac{3}{6} \times \frac{2}{6}\right)$ (At least 2 pairs & adding) — M1

+ $\left(\frac{3}{6} \times \frac{3}{6}\right)$ all correct — A1

= $\frac{21}{36}$; $\frac{7}{12}$; $0.58\dot{3}$; 0.583 — A1 — 5

Alt 2

Outcomes (2, 3), (3, 3), (3, 2)

Recognising 2 pairs
Can be implied — M1

All correct — A1

P(sum ≥ 5) = $\left(\frac{2}{6} \times \frac{3}{6}\right) + \left(\frac{3}{6} \times \frac{3}{6}\right) + \left(\frac{3}{6} \times \frac{2}{6}\right)$

Multiplying 2 pairs of 2 probs. & adding — M1

All correct — A1

= $\frac{21}{36}$ — A1 — 5

Solutions by EdExcel, compiled by www.mathssandpit.co.uk/blog

Alt 3

P (sum ≥ 5) = 12 $\left(\frac{1}{6}\times\frac{1}{6}\right)$ + 9 $\left(\frac{1}{6}\times\frac{1}{6}\right)$

a($p_1 \times p_2$) *or b*($p_1 \times p_2$) M1

$p_1 = p_2 = \frac{1}{6}$ A1

a( ) + b( ) M1

$= \underline{\frac{21}{36}}$

21 or 12 + 9 A1

$\frac{21}{36}$; $\frac{7}{12}$ *etc* A1 5

Alt 4

x	2	3	4	5	6
P($X = x$)	$\frac{1}{36}$	$\frac{4}{36}$	$\frac{10}{36}$	$\frac{12}{36}$	$\frac{9}{36}$

2, 3, 4, 5, 6 M1

Adding probabilities M1

All correct A1

$\therefore$P($X \geq 5$) = $\frac{12}{36} + \frac{9}{36}$

Adding P(5) & P(6) M1

$= \underline{\frac{21}{36}}$

$\frac{21}{36}$; $\frac{7}{12}$ *etc* A1 5

3. (a) $r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{-808.917}{\sqrt{113573\times 8.657}}$ M1

= –0.81579... A1 2

M1 for knowing formula and clear attempt to sub in correct values from question.
Root required for method.
Anything that rounds to –0.82 for A1.
Correct answer with no working award 2/2

(b) Houses are <u>cheaper</u> further away from the station or equivalent statement B1 1

Context based on negative correlation only required.
Accept <u>Houses</u> are <u>more expensive</u> closer to the <u>station</u> or equivalent statement.
Require 'house prices' or 'station' and clear correct comparison.

(c) –0.816 B1ft 1

Accept anything that rounds to –0.82 or 'the same' or 'unchanged' or equivalent.
Award B1 if value quoted same as answer to (a).

[4]

4. (a) 200 or 200g B1 1

"mean = 200g" is B0 but "median = 200" or just "200" alone is B1

(b) P(190 < X < 210) = 0.6 or P(X < 210) = 0.8
or P(X > 210) = 0.2 or diagram (o.e.) M1

Correct use of 0.8 or 0.2 A1

$Z = (\pm)\frac{210-200}{\sigma}$ M1

$\frac{10}{\sigma}$ = 0.8416 0.8416 B1

σ = 11.882129.... AWRT 11.9 A1 5

1st M1 for a correct probability statement (as given or eg P(200 < X < 210) = 0.3 o.e.) or shaded diagram – must have values on z-axis and probability areas shown

1st A1 for correct use of 0.8 or $p = 0.2$.
Need a correct probability statement.
May be implied by a suitable value for z seen (e.g. $z = 0.84$)

2nd M1 for attempting to standardise. Values for x and μ used in formula.
Don't need z = for this M1 nor a z-value, just mark standardization.

B1 for $z = 0.8416$ (or better) [$z = 0.84$ usually just loses this mark in (a)]

2nd A1 for AWRT 11.9

(c) $P(X < 180) = P\left(Z < \frac{180-200}{\sigma}\right)$ M1

$= P(Z < -1.6832)$
$= 1 - 0.9535$ M1
$= 0.0465$ or AWRT 0.046 A1 3

1st M1 for attempting to Standardise with 200 and their sd(>0) e.g. $(\pm)\frac{180-200}{\text{their }\sigma}$

2nd M1 **NB on epen this is an A mark ignore and treat it as 2nd M1**
for 1 – a probability from tables provided compatible with their probability statement.

A1 for 0.0465 or AWRT 0.046 (Dependent on both Ms in part (c))

Standardization in (b) and (c). They must use σ not σ^2 or $\sqrt{\sigma}$.

[9]

5. (a) $b = \frac{S_{xy}}{S_{xx}} = \frac{3477.6}{4402} = 0.7900\ldots$ B1

awrt0.79

$a = \bar{y} - b\bar{x} = 28.6 - (0.7900\ldots) \times 36 = 0.159836\ldots$ B1

awrt 0.16

$y = 0.16 + 0.79x$ B1ft 3

or equivalent

(b) **OR** just answer B1 ONLY
$y = 0.16 + 0.79 \times 45 = 35.71$ awrt 35.7 B1 1

[4]

6. (a) (Discrete) Uniform B1 1

(b) e.g. Tossing a fair dice / coin B1g 1

(c) Useful in theory – allows problems to be modelled B1g
not necessarily true in practice B1h 2

(d) Carry out an experiment B1g
to establish probabilities B1h 2

[6]

7. M1

Width	1	1	4	2	3	5	3	12
Freq. Density	6	7	2	6	5.5	2	1.5	0.5

0.5 ×12 or 6 A1

Total area is (1 × 6) + (1 × 7) + (4 × 2) + ..., = 70

(90.5 –78.5) × $\frac{1}{2} \times \frac{140}{\text{their } 70}$ M1

"70 seen anywhere" B1

Number of runners is 12 A1 5

1st M1 for attempt at width of the correct bar (90.5 – 78.5)
[Maybe on histogram or in table]

1st A1 for 0.5 × 12 or 6 (may be seen on the histogram).
Must be related to the area of the bar above 78.5 – 90.5.

2nd M1 for attempting area of correct bar × $\frac{140}{\text{their } 70}$

B1 for 70 seen anywhere in their working

2nd A1 for correct answer of 12.

Solutions by EdExcel, compiled by www.mathssandpit.co.uk/blog

Minimum working required is $2 \times 0.5 \times 12$ where the 2 should come from $\frac{140}{70}$

Beware $90.5 - 78.5 = 12$ (this scores M1A0M0B0A0)

Common answer is $0.5 \times 12 = 6$ (this scores M1A1M0B0A0)

If unsure send to review e.g. $2 \times 0.5 \times 12 = 12$ without 70 being seen

[5]

8. (a) $k + 2k + 3k + 4k + 5k = 1$ M1

$15k = 1$

verification / use of $\Sigma P(X = x) = 1$

** $k = \frac{1}{15}$ ** A1 2

cso

(b) $P(X < 4) = P(1) + P(2) + P(3) = \frac{1}{15} + \frac{2}{15} + \frac{3}{15}$ M1

sum of 3 probabilities

$= \frac{2}{5}$ A1 seen (2) 2

0.4 or $\frac{6}{15}$ or $\frac{2}{5}$

(c) $E(X) = 1 \times \frac{1}{15} + 2 \times \frac{2}{15} + 3 \times \frac{3}{15} + 4 \times \frac{4}{15} + 5 \times \frac{5}{15}$ M1

use of $\Sigma xP(X = x)$

$= \frac{11}{3}$ A1 2

$\frac{55}{15}$ *or* $\frac{11}{3}$ *or* $3\frac{2}{3}$ *or* $3.\dot{6}$ *or* 3.67

(d) $E(3X - 4) = 3E(X) - 4 = 11 - 4$ M1

3 × theirs-4

$= 7$ A1 seen (2)

(OR

$E(3X - 4) = -1 \times \frac{1}{15} + 2 \times \frac{2}{15} + 5 \times \frac{3}{15} + 8 \times \frac{4}{15} + 11 \times \frac{5}{15}$ M1

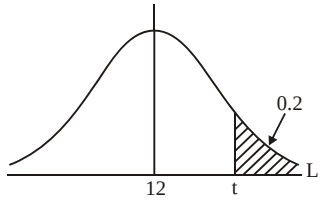
$\Sigma(3x - 4)kx$

$= 7$ A1 2

cao

[8]

9.



Let L represent lifetimes $\therefore L \sim N(12, 3^2)$

$P(L > t) = 0.2$ or $P(Z > \frac{t-12}{3}) = 0.2$ or diagram M1

$\therefore \frac{t-12}{3} = 0.8416$

$\therefore \underline{t = 14.5248}$

0.8146 B1

Allow σ, σ^2 $\sqrt{\sigma}$ $\frac{t-\mu}{\sigma} = \delta$ M1

all correct A1
solving M1
14.5 A1 6

[6]

Solutions by EdExcel, compiled by www.mathssandpit.co.uk/blog

Alternative

P($L > t$) = 0.2 M1

$\therefore$ P($L \le t$) = 0.8

$\therefore \ \dfrac{t-12}{3} = 0.84(18)$

$\therefore$ t = 14.52(14.5254)

0.84(18) B1

$\dfrac{t-12}{3} =$ *0.84(18)* A1

solving M1

14.5 A1

10. (a) $S_{xy} = 1818.5 - \dfrac{41 \times 406}{10}$, = 153.9 (could be seen in (b)) AWRT 154 M1, A1

$S_{xx} = 188 - \dfrac{41^2}{10} = 19.9$ (could be seen in (b)) A1 3

M1 for correct attempt or expression for either

1st A1 for one correct

2nd A1 for both correct

(b) $b = \dfrac{153.9}{19.9}$, = 7.733668.... AWRT 7.73 M1, A1

a = 40.6 – b × 4.1(= 8.89796....) M1

y = 8.89 + 7.73x A1 4

Ignore the epen marks for part (b) they should be awarded as per this scheme

1st M1 for $\dfrac{\text{their } S_{xy}}{\text{their } S_{xx}}$

1st A1 for AWRT 7.73

2nd M1 for attempt at correct formula for a (minus required).
Ft their b.
Quoting a correct formula but making one slip in sub.
eg. $\bar{y}$ = 406 is OK

2nd A1 for correct equation with 2dp accuracy.
Accept a = 8.89, and b = 7.73 even if not written as final equation.

Correct answers only (from calc) score 4/4 if correct to 2dp or 3/4 if AWRT 2dp

(c) A typical car will travel 7700 miles every year B1ft 1

B1ft for their b × 1000 to at least 2 sf.
Accept "7.7 thousand" but value is needed

(d) x = 5, y = 8.89 + 7.73 × 5(= 47.5 – 47.6) M1
So mileage predicted is AWRT 48000 A1 2

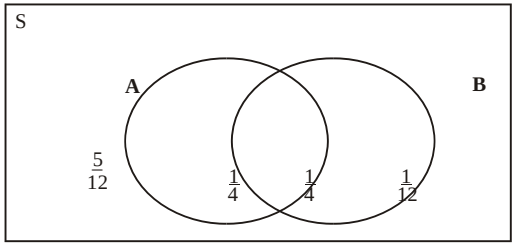
M1 for substituting x = 5 into their final answer to (b).

A1 for AWRT 48000 (Accept "48 thousands")

Accept calculations for S_{xx} and S_{xy} in (a) or (b)

[10]

11. (a)



2 intersecting closed curves in a box M1

both $\dfrac{1}{4}, \dfrac{1}{12}$ B1,B1

$\dfrac{5}{12}$ B1ft 4

(b) P($A \cup B$) = $\dfrac{7}{12}$ B1ft 1

0.583 or 0.583̇ or $\dfrac{7}{12}$

(c) P($A \mid B$) = $\dfrac{\text{P}(A \cup B')}{\text{P}(B')} = \dfrac{\frac{1}{4}}{\frac{2}{3}} = \dfrac{3}{8}$ or 0.375 M1,A1 2

their fractions divided, cao

[7]