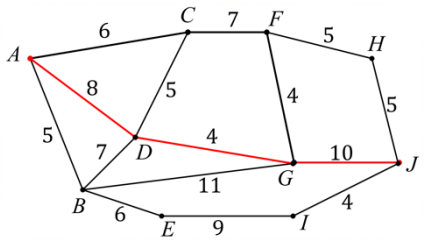
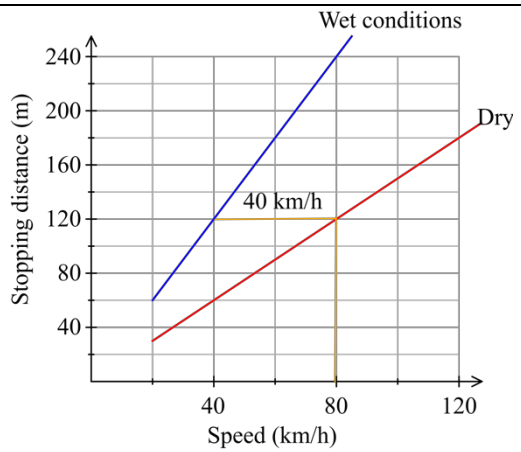
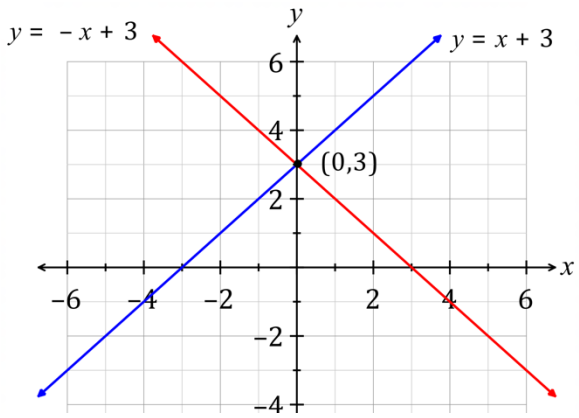
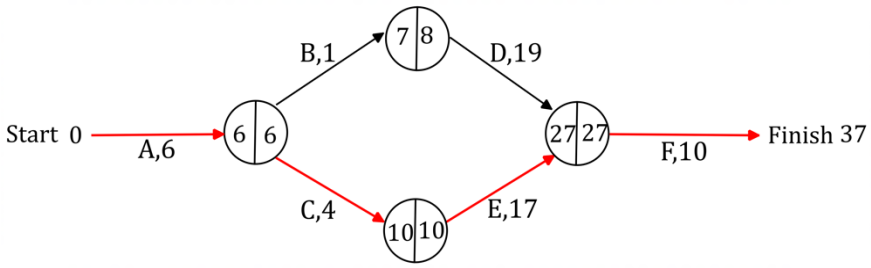
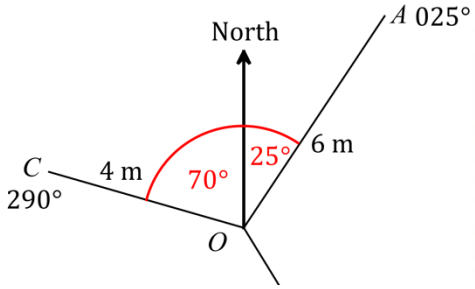
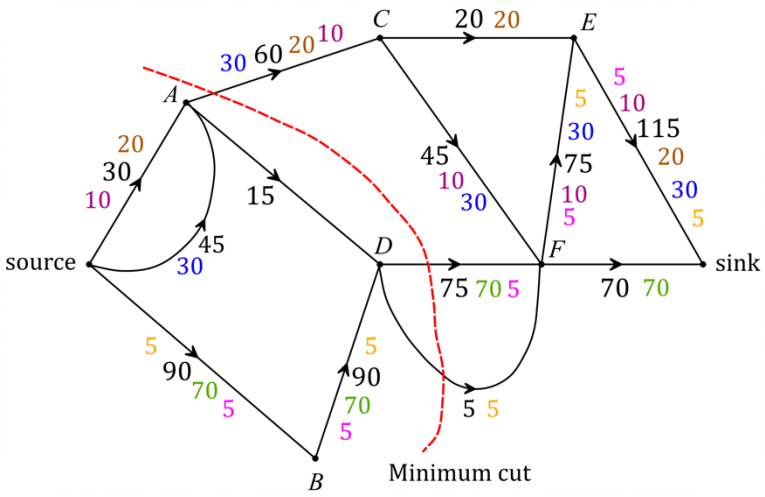
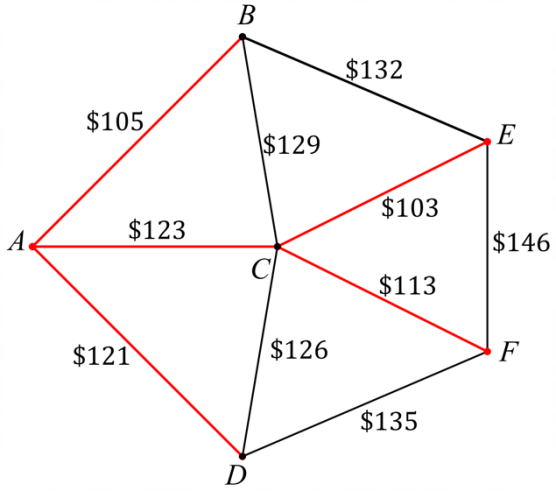
ACE Examination Paper 3
Year 12 Mathematics Standard 2 Yearly Examination
Worked solutions and marking guidelines

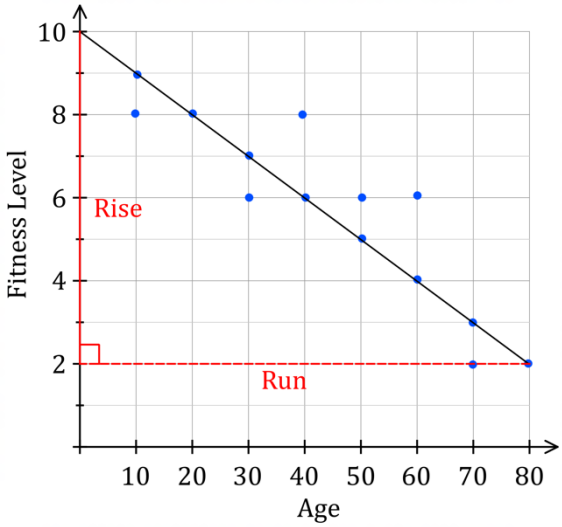
Section I		
	Solution	**Criteria**
1.	Shortest path is A–D–G–J Length $= 8 + 4 + 10$ $= 22$ km 	1 Mark: B
2.	Largest angle is opposite the largest side. $\cos\angle C = \dfrac{50^2 + 30^2 - 60^2}{2 \times 50 \times 30}$	1 Mark: A
3.	200 m $=$ 1 mm 10 m $= \dfrac{1}{20}$ mm 350 m $= \dfrac{35}{20}$ mm $= 1.75$ mm	1 Mark: C
4.	Stopping distance in dry conditions is 120 m at 80 km/h. Speed in wet conditions needs to be reduced to 40 km/h for a stopping distance of 120 m. Reduction in speed is 80 – 40 = 40 km/h 	1 Mark: A
5.	$N = 3000t^2$ $= 3000 \times 3^2$ $= 27\,000$	1 Mark: D
6.	Correlation between 0.5 and 0.74. $\therefore$ Moderate positive.	1 Mark: D
7.	$S = V_0(1 - r)^n$ $= 87\,500 \times (1 - 0.16)^4$ $= \$43\,563.744$ Depreciation $= 87\,500 - 43\,563.744$ $\approx \$43\,936.26$	1 Mark: C
8.	Convert all prices to the same quantity (250 mL) A: \$0.34 for 250 mL B: \$0.29 for 250 mL C: \$0.50 for 250 mL D: \$0.33 for 250 mL $\therefore$ Best price is \$2.00 for 1.75 L (\$0.29 for 250 mL)	1 Mark: B

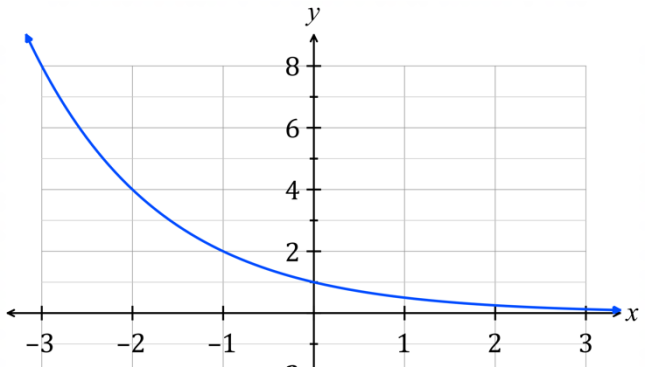
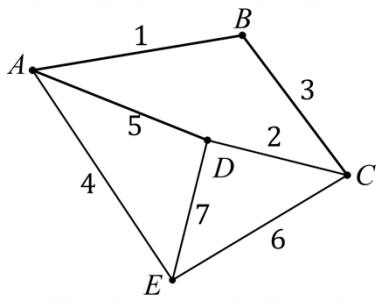
	Solution	Criteria
9.	 ∴ Point of intersection is (0, 3)	1 Mark: C
10.	Region is outside one standard deviation 100% – 68% = 32%	1 Mark: B
11.	Intersection value is 5.4172 (3% and 6 years) $PV = 5.4172 \times 12\,000$ $= \$65\,006.40$	1 Mark: C
12.	$FV = PV(1+r)^n$ $= 3500 \times (1 + 0.0007751)^{28}$ $= 3576.7599\ldots$ $\approx \$3576.76$ $I = FV - PV$ $= 3576.56 - 3500$ $= \$76.76$	1 Mark: B
13.	 ∴ Critical path is *ACEF*	1 Mark: D
14.	$z = \dfrac{x - \bar{x}}{s}$ $-2.5 = \dfrac{x - 72}{8}$ $x = (-2.5 \times 8) + 72$ $= 52\%$	1 Mark: A
15.	$A = \dfrac{1}{2}ab\sin C$ $= \dfrac{1}{2} \times 4 \times 6 \times \sin 95°$ $= 11.9543\ldots$ $\approx 12\ \text{m}^2$ 	1 Mark: D

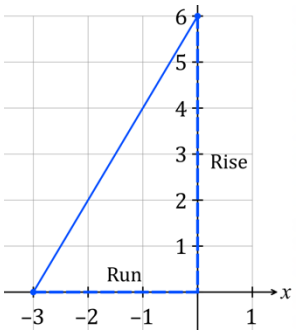
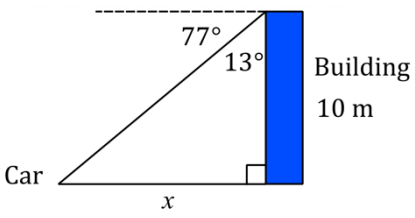
Section II		
	Solution	**Criteria**
16	Strong positive correlation indicates that when one variable increases the other variable increases. $\therefore$ Increased spending of advertising are associated with increased profits.	2 marks: Correct answer. 1 mark: Shows some understanding.
17(a)	Compounds every 6 months: r = 12% = 0.12, $n = 2 \times 3.5 = 7$ $S = V_0(1-r)^n$ $= 9200 \times (1-0.12)^7$ $= 3759.8154\ldots$ $\approx \$3759.82$ $\therefore$ Value of the computers is \$3759.82	2 marks: Correct answer. 1 mark: Finds r or n or shows some understanding.
17(b)	$S = V_0(1-r)^n$ $2000 = 9200 \times (1-0.12)^n$ $\frac{2000}{9200} = 0.88^n$ $0.88^n = 0.2173\ldots$ $n = \frac{\log 0.2173\ldots}{\log 0.88} = 11.9378\ldots \approx 12$ $\therefore$ Number of years is 12 to be less than \$2 000. Note: answer can also be obtained by trial and error.	2 marks: Correct answer. 1 mark: Substitutes at least two correct values into depreciation formula.
18(a)	There are 8 edges: *AB*, *AC*, *BC*, *BE*, *CE* ,*EF* ,*BD*, *DE*	1 mark: Correct answer.
18(b)	One vertex with degree 3 (vertex *C*)	1 mark: Correct answer.
18(c)	Yes, it is a connected graph. Connected graph if every vertex in the graph is accessible from every other vertex in the graph along a path formed by the edges of the graph.	1 mark: Correct answer.
18(d)	Cycle is a walk with no repeated vertices or edges that starts and ends at the same vertex. Cycles: *DEBD*, *DECBD*, *DECABD*	1 mark: Correct answer.
19	Electricity $= 0.9 \times 36$ $= 32.4$ kWh Cost $= 32.4 \times 0.2435$ $= 7.8894$ $\approx \$7.89$ $\therefore$ Cost of using the microwave is \$7.89.	2 marks: Correct answer. 1 mark: Finds the amount of electricity used by the microwave.
20(a)	Inflow for vertex *C* = 60 L Possible outflow for vertex C = 20 + 45 = 65 L Inflow is less than the possible outflow. $\therefore$ Outflow for vertex *C* is 60 L	1 mark: Correct answer.

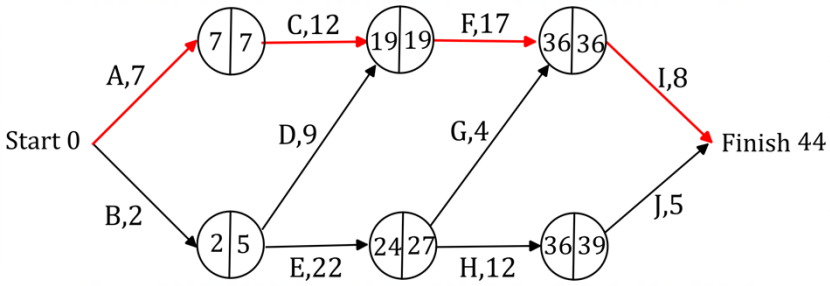
20(b)		2 marks: Correct answer. 1 mark: Shows some understanding.
20(c)	Maximum flow equals the minimum cut. Maximum flow $= 60 + 75 + 5$ $= 140$ L	1 mark: Correct answer.
21(a)	$v = 21 + 3n$ $= 21 + 3 \times 3$ $= 30$ $\therefore$ Value of the investment is \$30 000	1 mark: Correct answer.
21(b)	$v = 21 + 3n$ $48 = 21 + 3n$ $3n = 27$ $n = 9$ $\therefore$ Age of the investment is 9 years.	1 mark: Correct answer.
22(a)	Total paid = Loan repayment × Repayments $= 2370 \times 20 \times 12$ = \$568 800 $\therefore$ Total repaid after 20 years is \$568 800	1 mark: Correct answer.
22(b)	otal paid = Loan repayment × Repayments $= 2167 \times 25 \times 12$ = \$650 1000 Extra paid = 650 100 − 568 800 = \$81 300 $\therefore$ Extra paid is \$81 300	2 marks: Correct answer. 1 mark: Finds the amount to be repaid for 25 years.
23(a)	<table><tr><td></td><td>*A*</td><td>*B*</td><td>*C*</td><td>*D*</td><td>*E*</td><td>*F*</td></tr><tr><td>*A*</td><td>–</td><td>105</td><td>123</td><td>121</td><td>–</td><td>–</td></tr><tr><td>*B*</td><td>105</td><td>–</td><td>129</td><td>–</td><td>132</td><td>–</td></tr><tr><td>*C*</td><td>123</td><td>129</td><td>–</td><td>126</td><td>103</td><td>113</td></tr><tr><td>*D*</td><td>121</td><td>–</td><td>126</td><td>–</td><td>–</td><td>135</td></tr><tr><td>*E*</td><td>–</td><td>132</td><td>103</td><td>–</td><td>–</td><td>146</td></tr><tr><td>*F*</td><td>–</td><td>–</td><td>113</td><td>135</td><td>146</td><td>–</td></tr></table>	1 mark: Correct answer.

23(b)		2 marks: Correct answer. 1 mark: Draws a spanning tree or shows some understanding.
23(c)	Minimum cost $= 121 + 123 + 105 + 103 + 113$ $= \$565$ $\therefore$ Minimum cost to lay pipes to the garden is \$565.	1 mark: Correct answer.
24(a)	$\frac{\sin\theta}{32} = \frac{\sin 114}{76}$ $\sin\theta = \frac{32 \times \sin 114}{76}$ $= 0.3846\ldots$ $\theta = 22.6220\ldots \approx 23°$ $\therefore \angle UVT$ is approximately 23°	1 mark: Correct answer.
24(b)	To find $\angle VTU$ $\angle VTU + 114 + 22.6220\ldots = 180$ $\angle VTU = 43.3779\ldots$ $A = \frac{1}{2}ab\sin C$ $= \frac{1}{2} \times 32 \times 76 \times \sin 43.3779\ldots°$ $= 835.1582\ldots\ldots$ $\approx 835\ \text{mm}^2$	2 marks: Correct answer. 1 mark: Finds $\angle VTU$ or uses area of a triangle formula with one correct value.
25(a)	$FV = PV(1+r)^n$ $= 9000 \times (1 + 0.0046)^5$ $= 11\,269.4035\ldots$ $\approx \$11\,269.40$ $\therefore$ Future value is \$11 269.40	1 mark: Correct answer.
25(b)	$PV = \frac{FV}{(1+r)^n}$ $= \frac{480\,000}{\left(1 + \frac{0.082}{12}\right)^{8\times12}}$ $= 249\,639.3506\ldots$ $\approx \$249\,639.35$ $\therefore$ Present value is \$249 639.35	2 marks: Correct answer. 1 mark: Finds the interest rate per month or the time period.

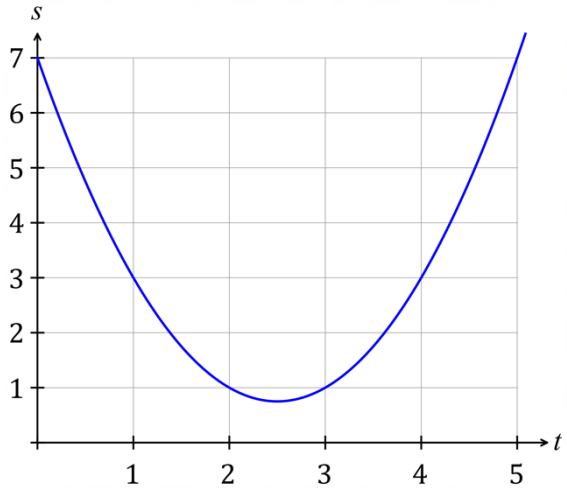
26(a)	$t = \frac{k}{n}$ $\quad t = \frac{10}{n}$ $2 = \frac{k}{5}$ $\quad = \frac{10}{4}$ $k = 10$ $\quad = 2.5$ days $\therefore$ It takes 2.5 days for 4 people to fit the insulation.	2 marks: Correct answer. 1 mark: Finds the value of k or shows some understanding
26(b)	$t = \frac{10}{n}$ $1 = \frac{10}{n}$ $n = 10$ people $\therefore$ It takes 10 people to fit the insulation in 1 day.	1 mark: Correct answer.
27(a)	Dimensions of the second bedroom: 3.0 m by 3.0 m $\therefore$ Suitable scale is 1 cm: 1 m or 1:100 (Accept answers from 1:90 to 1:110)	1 mark: Correct answer.
27(b)	Drawing dimensions of the lounge room are 4.0×3.7 cm Actual dimensions using the scale are 4.0×3.7 m $A = lb = 4.0 \times 3.7$ $= 14.8$ m^2 $\therefore$ Area of the lounge room is approximately 15 m^2.	2 marks: Correct answer. 1 mark: Finds the drawing dimensions.
27(c)	Cost $= 15 \times 150$ $= \$2250$ $\therefore$ Cost of carpeting the lounge room is about \$2250.	1 mark: Correct answer.
28(a)	 $m = \frac{\text{Rise}}{\text{Run}} = -\frac{8}{80} = -0.1$ $\therefore$ Gradient is –0.1	2 marks: Correct answer. 1 mark: Finds the line of best fit or shows some understanding.
28(b)	When age = 30 then fitness level = 7 (from the scatterplot) $\therefore$ Lachlan's fitness level should be 7.	1 mark: Correct answer.
28(c)	Data: (10,8)(10,9)(20,8)(30,6)(30,7)(40,6)(40,8) (50,5)(50,6)(60,4)(60,6)(70,2)(70,3)(80,2) $r = -0.9115\ldots$ ≈ -0.91	2 marks: Correct answer. 1 mark: Finds a value of r close to –0.9.

29(a)	Dividend $= 1500 \times 0.24$ $= \$360$ $\therefore$ Ben receives a dividend of \$360.	1 mark: Correct answer.
29(b)	Dividend yield $= \dfrac{0.24}{1.80} \times 100\%$ $= 13.3333\ldots$ $\approx 13.3\%$ $\therefore$ Dividend yield is 13.3 %	1 mark: Correct answer.
30(a)	$z = \dfrac{x - \bar{x}}{s}$ $-1 = \dfrac{x - 12.5}{0.5}$ $x = (-1 \times 0.5) + 12.5$ $= 12$ $\therefore$ Minimum weight to be accepted is 12 kg.	1 mark: Correct answer.
30(b)	$z = \dfrac{x - \bar{x}}{s}$ $2 = \dfrac{x - 12.5}{0.5}$ $x = (2 \times 0.5) + 12.5$ $= 13.5$ $\therefore$ Maximum weight to be accepted is 13.5 kg.	1 mark: Correct answer.
31	<table><tr><td>x</td><td>−3</td><td>−2</td><td>−1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y</td><td>8</td><td>4</td><td>2</td><td>1</td><td>0.5</td><td>0.25</td><td>0.125</td></tr></table> 	3 Marks: Correct answer. 2 mark: Completes the table of values and draws the correct shape of the curve. 1 mark: Completes the table of values or draws the correct shape of the curve.
32	Weighted edges: $AB = 1, AD = 5, AE = 4, BC = 3, CD = 2, CE = 6, DE = 7$ 	2 marks: Correct answer. 1 mark: Draws the vertices with at least one correct edge.

33(a)	$\angle DOG = 317 - 247$ $= 70°$	1 mark: Correct answer.
33(b)	$a^2 = b^2 + c^2 - 2bc\cos A$ $DG^2 = 48^2 + 49^2 - 2 \times 48 \times 49 \times \cos 70°$ $DG = 55.6429\ldots$ ≈ 56 m $\therefore$ Length of DG is 56 m.	2 marks: Correct answer. 1 mark: Uses cosine rule with one correct value.
34(a)	Intersection value is 4.51 (8% and 4 years) $FV = 4.51 \times 32\,000$ $= \$144\,320$	1 mark: Correct answer.
34(b)	Intersection value is 4.25 (4% and 4 years) $FV = 4.25 \times 6300$ $= \$26\,775$	1 mark: Correct answer.
35	Points $(-3, 0)$ and $(0, 6)$ Gradient $= \frac{\text{Rise}}{\text{Run}}$ $= \frac{6}{3}$ $= 2$ 	2 marks: Correct answer. 1 mark: Makes some progress.
36	$\tan 13° = \frac{x}{10}$ $x = \tan 13° \times 10$ $= 2.3086\ldots$ ≈ 2.31 m $\therefore$ Distance of the car from the building is 2.31 m 	2 marks: Correct answer. 1 mark: Draws a diagram with at least one correct value.
37(a)	Costs when no cameras are sold or $n = 0$ $C = 20n + 1500$ $= 2 \times 0 + 1500 = \$1500$ $\therefore$ Fixed costs are \$1500	1 mark: Correct answer.
37(b)	$I = 80n$ $= 80 \times 400$ $= \$32\,000$ $\therefore$ Income from selling 4000 cameras is \$32 000	1 mark: Correct answer.
37(c)	$C = 20n + 1500$ $= 2 \times 400 + 1500 = \$2\,300$ $\therefore$ Cost of 400 cameras is \$2 300	1 mark: Correct answer.
37(d)	Profit $= 32\,000 - 2\,300$ $= \$29\,700$ $\therefore$ Profit is \$29 700	1 mark: Correct answer.

37(e)	Break-even occurs when income equals costs. $80n = 20n + 1500$ $60n = 1500$ $n = 25$ $\therefore$ Break-even occurs when 25 cameras are sold.	2 marks: Correct answer. 1 Mark: Recognises that income equals costs.
38(a)	Balance $= 8400 + 780 + 250$ $= \$9430$	1 mark: Correct answer.
38(b)	Minimum payment $= 9430 \times 0.03 \times 1$ $= \$282.90$	1 mark: Correct answer.
38(c)	$FV = PV(1+r)^n$ $= (9430 - 282.90) \times \left(1 + \frac{0.24}{12}\right)$ $= 9330.042$ $\approx \$9330.04$ $\therefore$ Amount owing is \$9330.04	1 mark: Correct answer.
39	$r = \frac{0.06}{12} = 0.005$ $D = 810$ and $V_0 = 58\,000$ Recurrence relation $V_{n+1} = V_n \times (1+r) - D$ $= V_n \times 1.005 - 810$	2 marks: Correct answer. 1 mark: Substitutes one correct value into the recurrence relation.
40(a)		3 marks: Correct answer. 2 marks: Completes the EST or LST. 1 mark: Draws a network diagram with some correct edges .
40(b)	Critical path is *ACFI*	1 mark: Correct answer.
40(c)	Minimum time for completion is 44 minutes	1 mark: Correct answer.
41(a)	$z = \frac{x - \bar{x}}{s}$ $= \frac{54.3 - 61.5}{3.6}$ $= -2$	1 mark: Correct answer.

<table>
<tr><td>41(b)</td><td>$z = \dfrac{x - \bar{x}}{s}$
$= \dfrac{53.4 - 59.2}{5.8}$
$= -1$
Now 68% of scores have a z-score between –1 and 1.
Percentage $= \dfrac{100 - 68}{2}$
$= 16\%$</td><td>2 marks: Correct answer.

1 mark: Finds Edwards z-score.</td></tr>
<tr><td>41(c)</td><td>In swimming the lower times are better than the higher times.
Victoria is 2 standard deviations below the mean while Edward is 1 standard deviation below the mean.
$\therefore$ Victoria has performed better.</td><td>1 mark: Correct answer.</td></tr>
<tr><td>42(a)</td><td><table><tr><td>Time (t)</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Speed (s)</td><td>7</td><td>3</td><td>1</td><td>1</td><td>3</td><td>7</td></tr></table></td><td>1 mark: Correct answer.</td></tr>
<tr><td>42(b)</td><td> 
</td><td>1 mark: Correct answer.</td></tr>
<tr><td>42(c)</td><td>Lowest speed occurs when time is 2.5. (Read from the graph)</td><td>1 mark: Correct answer.</td></tr>
<tr><td>42(d)</td><td>$s = t^2 - 5t + 7$
$= (2.5)^2 - 5 \times 2.5 + 7$
$= 0.75$
$\therefore$ Lowest speed is 0.75</td><td>1 mark: Correct answer.</td></tr>
</table>