Nat 5

USAP 3(a)

This booklet contains :

- Questions on Topics covered in RHS USAP 3(a)
- Exam Type Questions
- Answers

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USAP 3(a)

APP 4.1 Comparing data sets using statistics

- **Compare data sets using calculated/determined:**
  - **Quartiles and interquartile range**
  - **Standard deviation**

APP 4.2 Forming a linear model from a given set of data

- **Determine the equation of a best – fitting straight line on a scattergraph and use it to estimate *y* given *x***

REL 2.1 Recognise and determine the equations of quadratics from their graphs

- **Equations of the form $y = kx^2$ and $y = (x + p)^2 + q$ for integer values of *p, q* and *k***

REL 2.2 Sketching a quadratic function

- **Equations in the form $y = (x – d)(x – e)$ and $y = (x + p)^2 + q$**

REL 2.3 Identifying features of a quadratic function

- **Identify nature, coordinates of turning point and the equation of axis of symmetry of quadratic in the form $y = k(x + p)^2 + q$ where $k = 1$ or -1**
- **Know the meaning of the roots of a quadratic equation**

APP 4.1 COMPARING DATA SETS

QUARTILES AND INTERQUARTILE RANGE

1. For each of the data sets below find the median, lower quartile, upper quartile and interquartile range.

(a)	2	4	4	6	7	8	10	14	15			
(b)	29	30	32	33	34	37	40					
(c)	17	19	20	22	23	25	26					
(d)	0	0	0	1	1	2	2	2	3	3	4	
(e)	1·8	1·8	2·8	2·9	4·0	4·0	4·0	4·7	5·1	5·2	5·3	
(f)	0·13	0·18	0·18	0·19	0·25	0·26	0·29	0·29	0·30	0·31	0·33	0·39
(g)	133	136	136	138	140	141	143	145				
(h)	371	375	376	379	380	384	385	387	389	390		
(i)	57	58	58	60	63	67	67	69	82	85	86	90
(j)	11	11	11	12	13	14	15	15	16	18	20	

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2. For each of the data sets below find the median, lower quartile, upper quartile and interquartile range.

(a)	47	56	58	48	60	65	50	52	61	53	63	
(b)	12	20	27	15	35	16	26	34	38	24	26	
(c)	149	165	154	167	170	179	151	168	158			
(d)	1	8	3	1	2	5	3	1	4	3	2	
(e)	108	114	132	95	144	120	116	125	172	188	155	160
(f)	65	74	59	43	63	52	48	63	67	85	92	48
(g)	190	165	174	187	166	172	184	190	166	183	180	
(h)	325	363	347	359	314	329	364	372	301	317	346	
(i)	0·5	1·3	0·4	1·0	0·9	1·4	0·8	0·9	1·1	0·6		
(j)	10	13	11	11	20	10	10	14	50	10	11	10

COMPARING DATA SETS

STANDARD DEVIATION

1. Calculate the mean and standard deviation for the following sets of data.

(a)	20	21	19	22	21	20	19	20	21	20	
(b)	303	299	306	298	304	307	299	302	305	299	300
(c)	15·3	14·9	15·1	15·2	14·8	14·7	15·1	14·8	15·0	15·0	
(d)	87	89	84	88	89	87	86	87	86	87	
(e)	48	73	29	82	54	43	95	41	92	71	
(f)	4·4	4·6	4·8	4·0	4·2	4·3	4·5	4·7	4·9	4·1	
(g)	0·2	0·3	0·4	0·2	0·2	0·0	0·4	0·1	0·2	0·3	
(h)	40	40	39	38	38	40	40	42	40	39	

2. A third year pupil conducting an experiment with a die got the following results

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

(a) Show these results in a frequency table

(b) Use your table to calculate the mean and standard deviation.

3. A company that manufactures shoelaces spot checks the length (in cm) of the laces.

Here are the results for two different production lines.

Line A	26·8	27·2	26·5	27·0	27·3	27·5	26·1	26·4	27·9	27·3
Line B	26·8	26·7	27·1	27·0	26·9	27·0	27·3	26·9	27·0	27·3

Calculate the mean and standard deviation and comment on any differences between line A and line B.

4. The running times, in minutes, of films shown on television over a week are as follows.

110	95	135	70	100	125	140	105	95	105
95	95	110	90	110	100	125	105	90	120

Calculate the mean and standard deviation.

5. The temperatures, in ^{o}C, at a seaside resort were recorded at noon over a 10-day period.

19	20	19	17	21	18	19	24	25	28

Calculate the mean and standard deviation.

6. John James plays golf with his brother Joe each month. They keep a note of their scores.

John	74	73	74	73	71	73	72	75	73	73	72	73
Joe	68	74	70	67	80	81	69	68	79	67	70	71

Calculate the mean and standard deviation and comment on John's and Joe's performance over the year.

7. The weekly takings in small store, to the nearest £, for a week in December and March are shown below

December	2131	2893	2429	3519	4096	4810
March	1727	2148	1825	2397	2901	3114

Calculate the mean and standard deviation and comment on any differences.

8. Two sixth year classes take part in a Sponsored Fast for Famine Relief. The number of hours each pupil lasted are shown below.

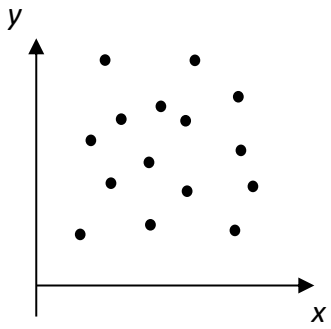
6C1	20	22	21	20	22	20	22	20	20	24	21	22	23	22	22	23
6C2	15	20	24	23	22	24	18	24	22	23	24	17	20	24	24	20

Calculate the mean and standard deviation for each class and comment on how well each class did.

APP 4.2 FORMING a LINEAR MODEL from a given SET of DATA

1. Using the words positive, negative or no relation, describe the correlation in each of the diagrams below.

(a)



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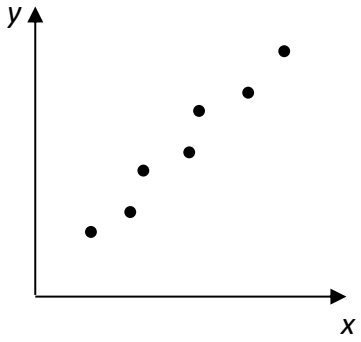

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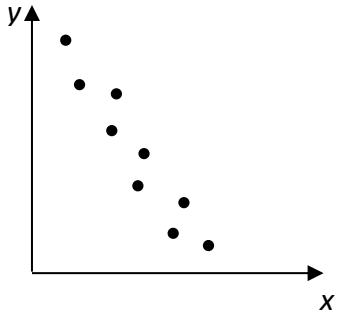
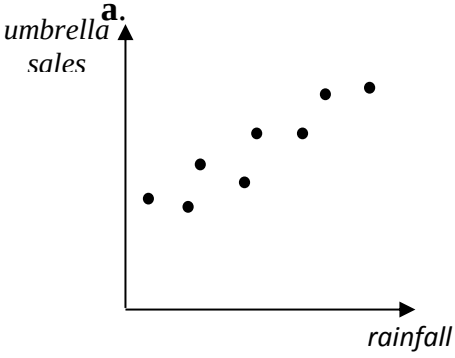
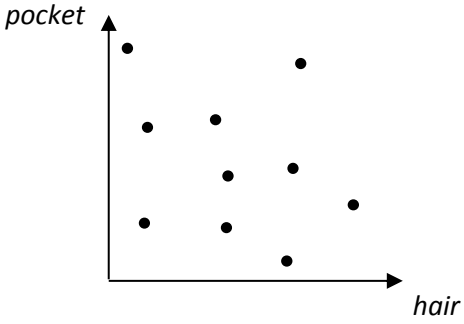


2. What do the diagrams tell you about the correlation between the two variables involved ?

a.



b.



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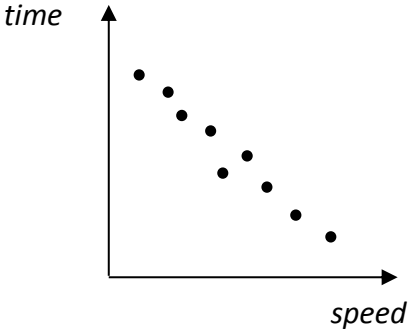


3. A random survey of 20 pupils gave the following results

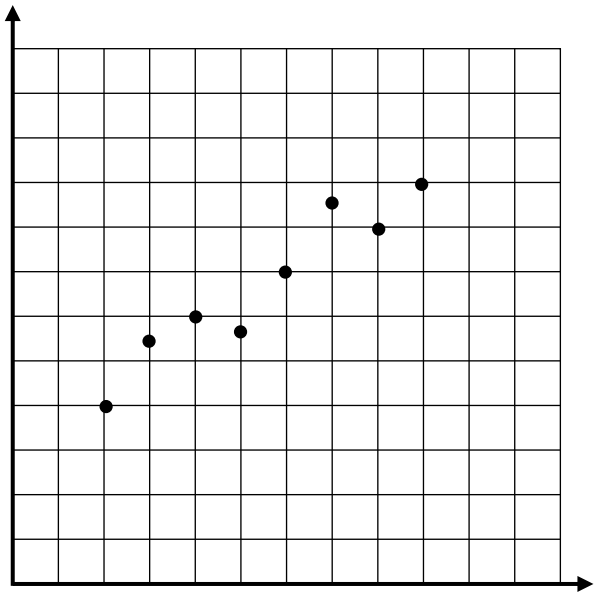
Pupil	1	2	3	4	5	6	7	8	9	10
Age	16	17	14	17	14	12	12	16	18	15
Height(cm)	182	199	171	200	183	159	170	179	198	180
Weight (kg)	71	78	69	66	54	60	46	72	76	63
Cash carried (£)	4·23	10·90	25·50	1·43	2·98	6·24	3·18	0·72	1·98	0·25

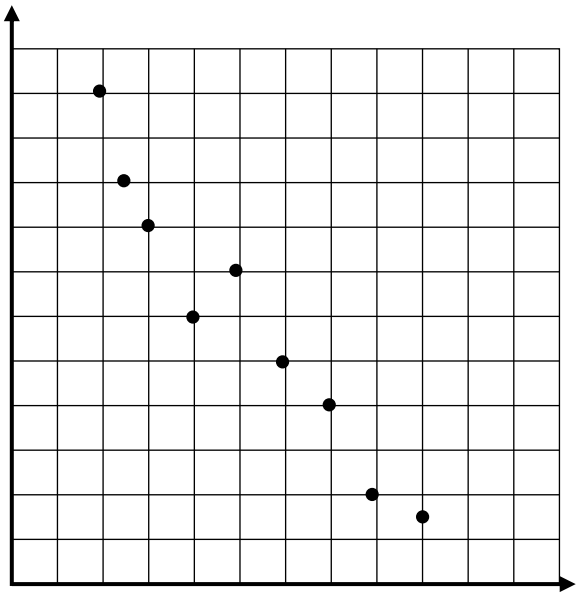
Pupil	11	12	13	14	15	16	17	18	19	20
Age	18	18	17	16	11	11	13	12	14	14
Height (cm)	190	179	187	169	160	151	150	171	170	182
Weight (kg)	68	75	77	76	49	41	55	53	60	67
Cash carried	12·06	4·31	2·38	12·30	2·15	4·12	2·71	0·40	1·80	3·10

Draw a scatter diagram to find out if there is a correlation between

(a) age and height
(b) height and weight
(c) age and weight
(d) age and amount of cash carried.

4. Copy these graphs and use your ruler to draw what you think is the line of best fit.





5. For the following sets of data, draw a scatter diagram and find the equation of the line of best fit.

(a)

x	1	2	3	4	5
y	5	7	8	10	12

(b)

x	1	2	3	4	5
y	2	2·5	2·5	3·5	3

(c)

x	6	7	8	9	10
y	1	2	4	4·5	6

(d)

x	1	2	3	4	5
y	8	6	5	4	2

(e)

x	1	2	3	4	5
y	8	10	8	5	3

(f)

x	5	6	7	8	9
y	6	5·5	5·4	5·5	5

6. The height of a plant measured over five days is shown below.

Days (D)	1	2	3	4	5
Height (H)	1·6	1·9	2·5	3·4	3·5

(a) Plot the points and draw the best fitting straight line through them
(b) Work out the equation of the line.
(c) Use your line to estimate the height after 1½ days.

7. The table shows the results of an experiment.

x	1	2	3	4	5	6
y	9·2	12·0	18·3	19·0	25·1	30·2

Plot the points, draw a best fitting straight line and find its equation.

8. The results below show the length of a spring when a force is applied.

Force (F)	1	2	3	4	5	6
Length (l)	3·0	3·9	4·8	5·9	6·9	8·1

(a) Plot the points and draw the best fitting straight line through them.
(b) Find the equation of the line.
(c) Use your graph to estimate the length when a force of 4·5 is applied.

9. The following table gives the temperature of a bottle of water as it cools.

Time, min (T)	1	3	5	7	9
Temperature (^oC)	66	61	57	53	50

(a) Plot the points and draw the best fitting straight line through them.
(b) Find the equation of the line.
(c) Use your graph to estimate the temperature after 2½ minutes.

10. The following table shows the speed of a car accelerating from rest.

Time (secs)	0	2	6	8	12	16
Speed (mph)	0	14	44	56	82	110

(a) Plot the points and draw the best fitting straight line through them.
(b) Find the equation of the line.
(c) Use your graph to estimate the speed after 10 seconds.

11. A restaurant manager finds that the cost of running his restaurant depends on the number of meals served.

Number of meals	10	20	30	40	50	60
Cost in £	188	192	220	216	232	248

(a) Plot the points and draw the best fitting straight line through them.
(b) Find the equation of the line.
(c) Use your equation to estimate the cost when 35 meals are served.

12. The results of an experiment are shown in the table below.

V	0	0·35	0·6	0·95	1·2	1·3
R	0·60	0·48	0·33	0·18	0·11	0·05

(a) Plot the points and draw the best fitting straight line through them.
(b) Find the equation of the line.
(c) Use your graph to estimate ***R*** when ***V*** is 0.8.

EXAM QUESTIONS

MEAN and STANDARD DEVIATION

1. The weights of 6 plums are

40·5g 37·8g 42·1g 35·9g 46·3g 41·6g

(a) Calculate the mean and standard deviation.

The weights of 6 apples are

140·5g 137·8g 142·1g 135·9g 146·3g 141·6g

(b) **Write down** the mean and standard deviation.

2. During a recent rowing competition the times, in minutes, recorded for a 2000 metre race were

7·2 7·3 7·3 7·5 7·6 8·4

(a) Calculate the mean and standard deviation of these times. Give both answers correct to 2 decimal places.

(b) In the next race the mean time was $7 \cdot 76$ and the standard deviation was $0 \cdot 49$.

Make two valid comments about this race compared to the one in part (a).

3. 6 friends joined "Super Slimmers", a weight loss class. Their weights were recorded and the results are shown below.

65kg 72kg 74kg 81kg 90kg 98kg

(a) Calculate the mean and standard deviation of the weights.

After 6 weeks the mean weight was 74kg and the standard deviation was 8·6

(b) Compare the mean and standard deviation of the friend's weights.

4. Stewart and Jenni complete a crossword puzzle every day. Here are the times (in minutes) that Stewart took to complete it each day for a week.

63 71 68 59 69 75 57

(a) Calculate the mean and standard deviation for Stewart's times.

Every day Jenni took exactly 5 minutes longer than Stewart to complete the puzzle.

(b) Write down Jenni's mean and standard deviation.

5. The number of hours spent studying by a group of 6 student nurses over a week were

20 23 14 21 27 24

(a) Calculate the mean and standard deviation of this data.

(b) A group of student teachers had a mean of 21·5 and a standard deviation of 6.

Make two valid comments to compare the study times of the 2 groups of students.

6. Barbara is looking for a new 'A-Pod' and searches for the best deal.

The costs of the 'A-Pod' are shown below.

£175 £185 £115 £87 £150 £230

(a) Calculate the mean and standard deviation of the above data.

(b) A leading competitor, the 'E-Pod', has a mean price of £170 and a standard deviation of 26·7. Make **two** valid comparisons between the 2 products.

7. In Bramley's Toy Shop there are 6 styles of teddy bear. The price of each is sh

£19 £25 £17 £32 £20 £22

(a) Calculate the mean and standard deviation of these prices.

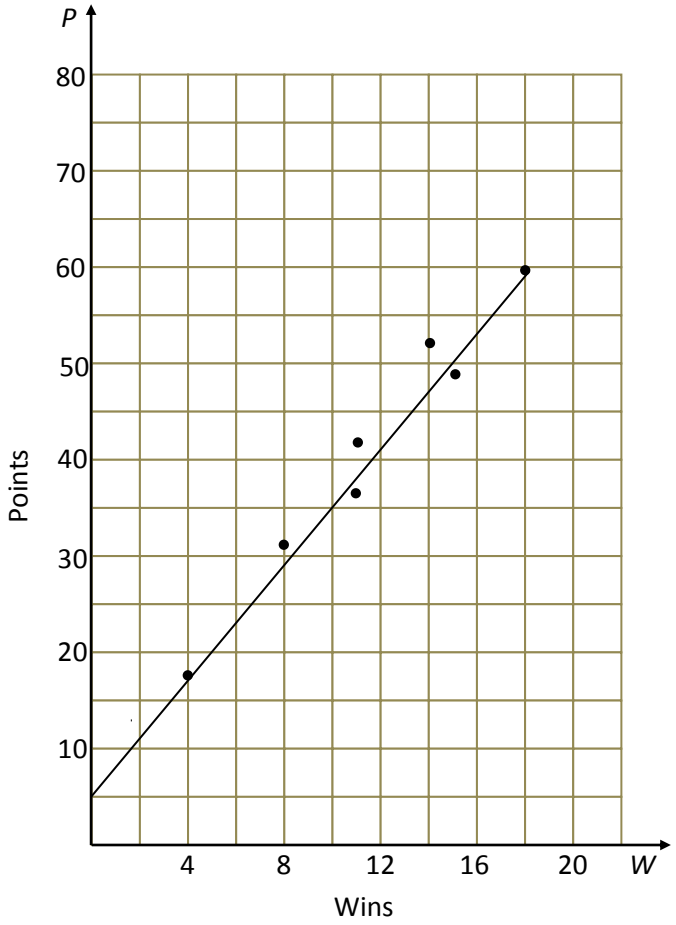
In the same shop the prices of the dolls have a mean of £22.50 and a standard deviation of 2·3.

(b) Compare the two sets of data making particular reference to the spread of the prices.

EXAM QUESTIONS

FORMING a LINEAR MODEL from a given SET of DATA

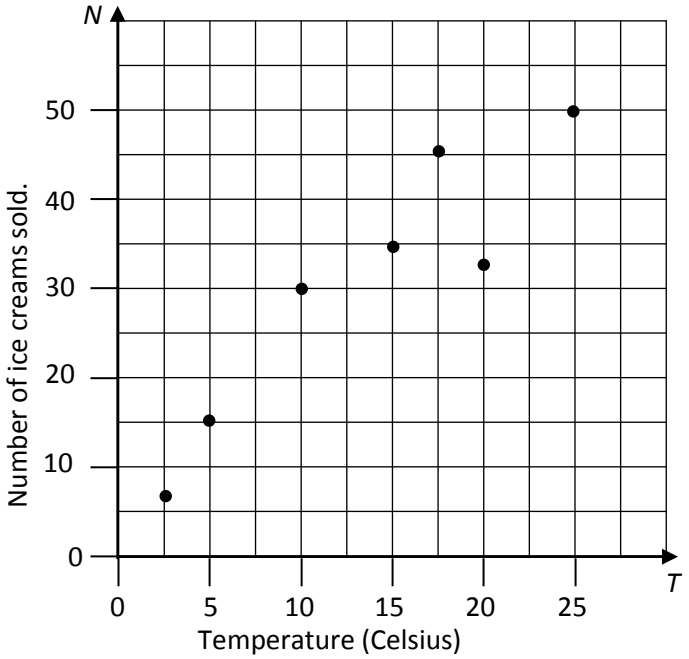
1. A selection of the number of games won and the total points gained by teams in the Scottish Premier League were plotted on this scattergraph and the line of best fit was drawn.



(a) Find the equation of the line of best fit.

(b) Use your equation to calculate the points gained by a team who won 27 matches.

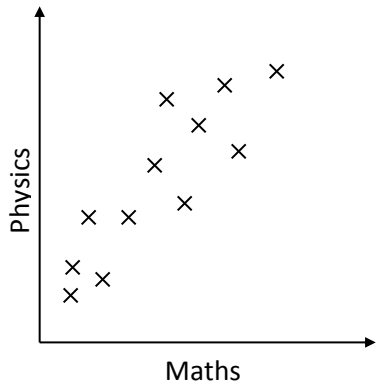
2. The graph below shows the temperature and sales of ice cream for one week during the summer.



(a) Make a copy of the graph and draw the line of best fit on it.

(b) Find the equation of the best-fit line.

3. The scattergraph shows the marks gained in Physics and Maths by a group of college students.



Which of the following statements best describes the correlation between the 2 sets of marks?

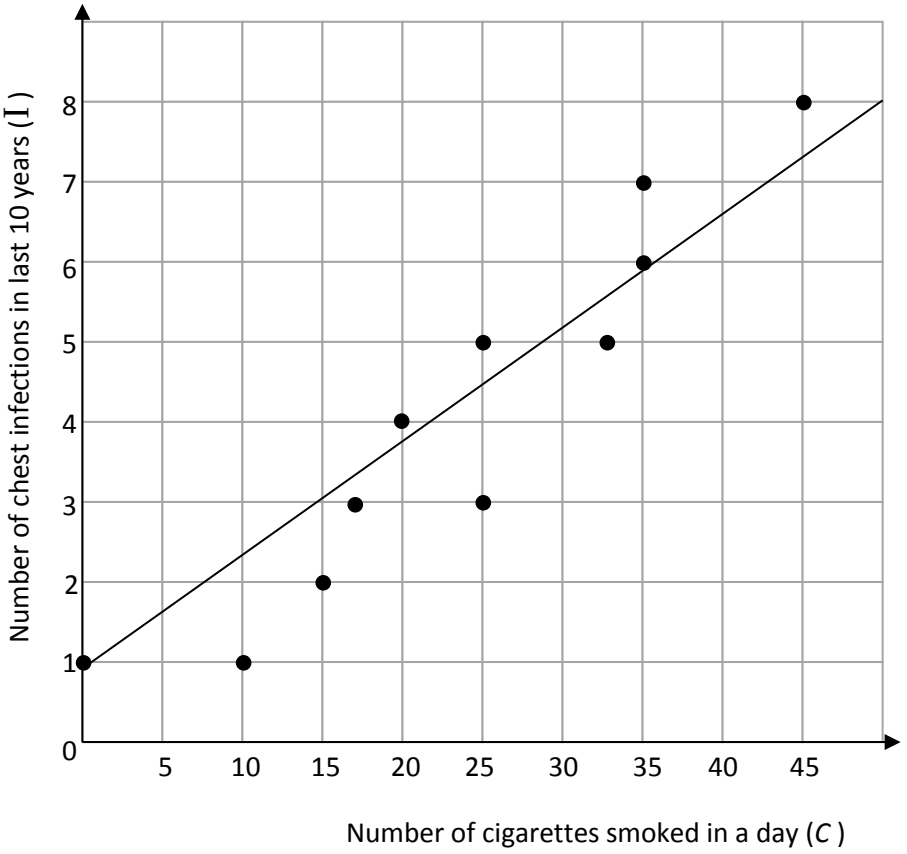
A strong positive correlation

B strong negative correlation

C weak positive correlation

D weak negative correlation

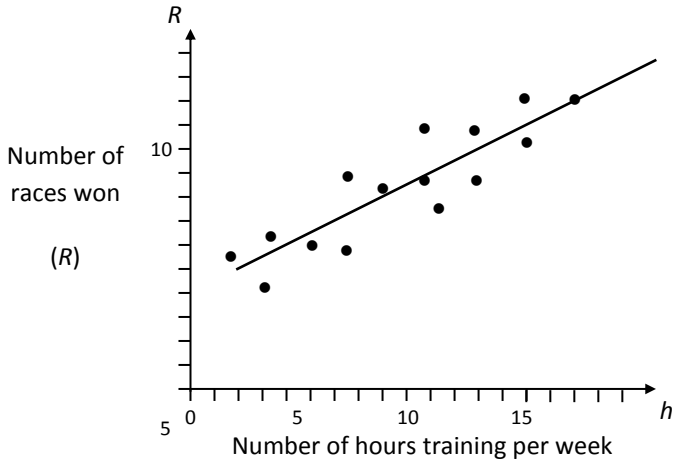
4. A group of smokers were asked how many cigarettes they smoked in a day and how many chest infections they had suffered in the last ten years. The results are shown in the scattergraph with the line of best fit drawn.



(a) Comment on the correlation between the 2 sets of data.

(b) Find the equation of the line of best fit.

5. The graph below shows the relationship between the number of hours (h) a swimmer trains per week and the number of races (R) they have won.



A best fitting straight line has been drawn.

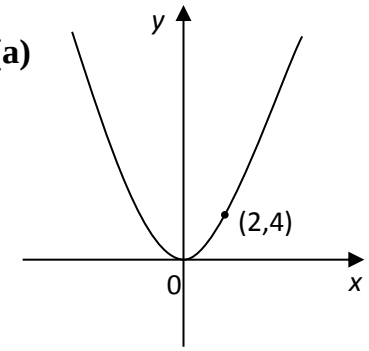
(a) Use information from the graph to find the equation of this line of best fit.

(b) Use the equation to predict how many races a swimmer who trains 22 hours per week should win.

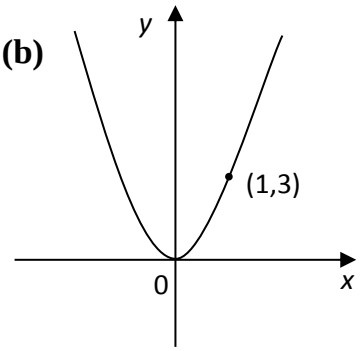
REL 2.1 RECOGNISE and DETERMINE the EQNS of QUADRATICS from their GRAPHS

1. Write down the equation of the graphs shown below, which have the form $y = kx^2$.

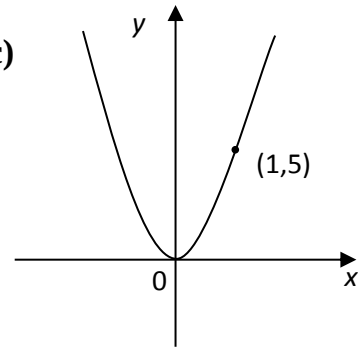
(a)



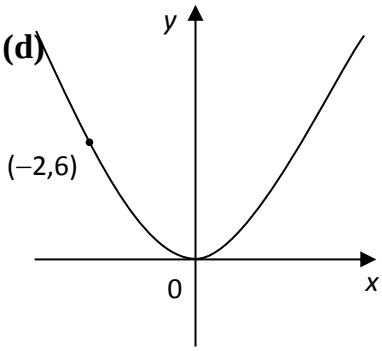
(b)



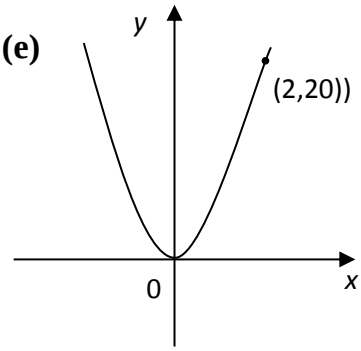
(c)



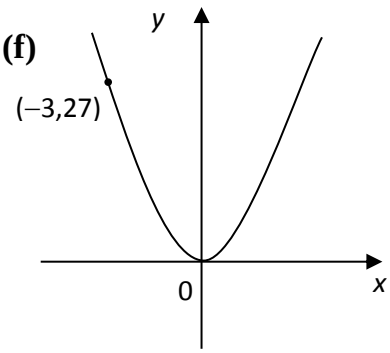
(d)



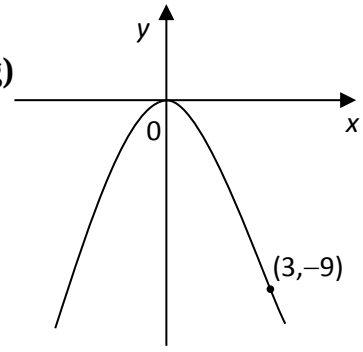
(e)



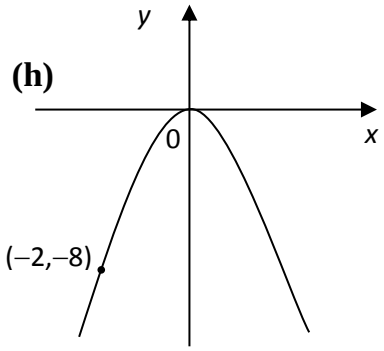
(f)



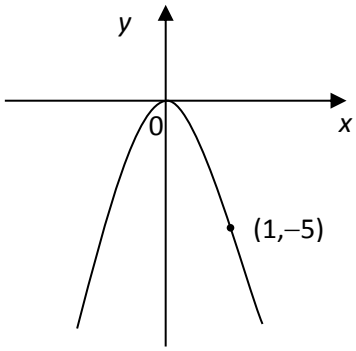
(g)



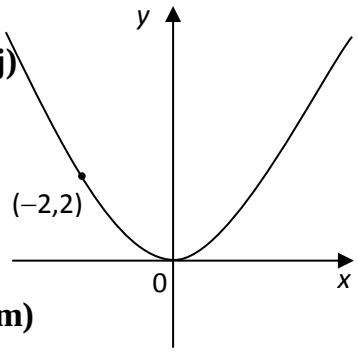
(h)



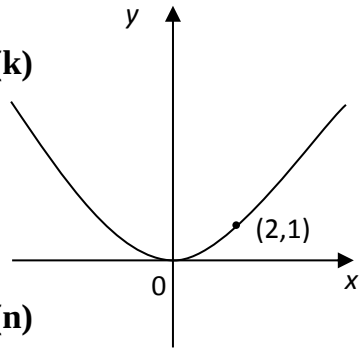
(i)



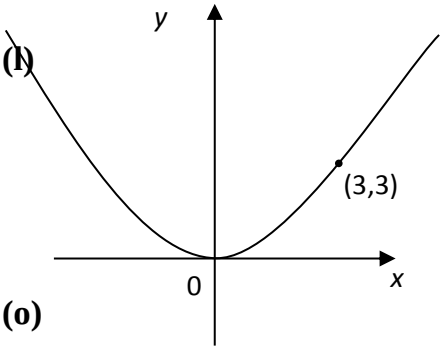
(j)



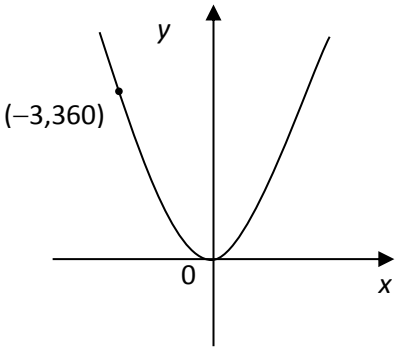
(k)



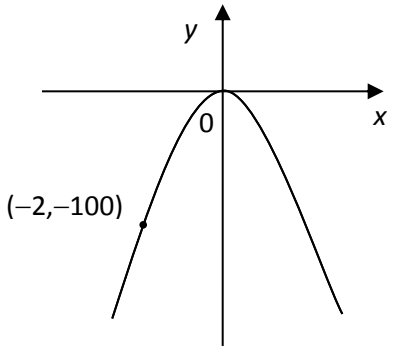
(l)



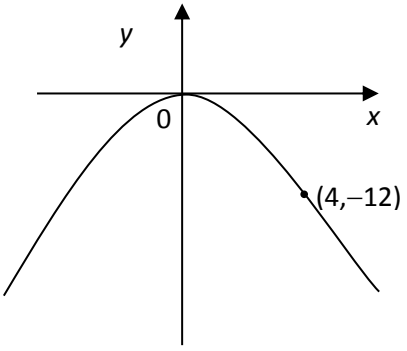
(m)



(n)

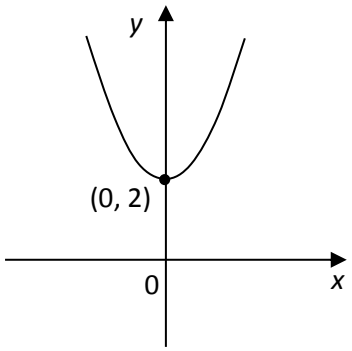


(o)

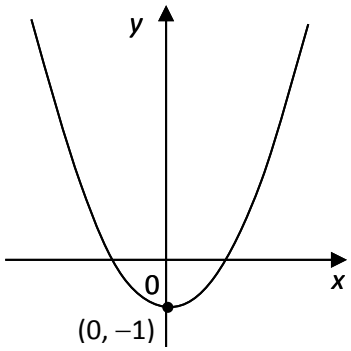


2. Write down the equation of the graphs shown below, which have the form $y = ax^2 + b$.

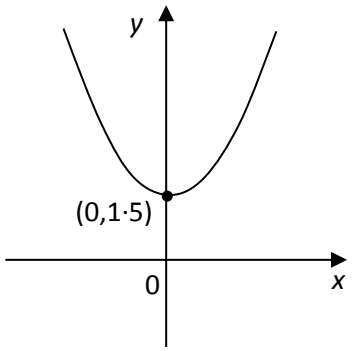
(a)



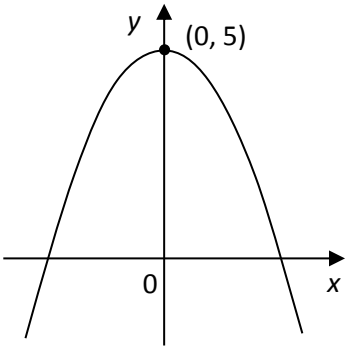
(b)



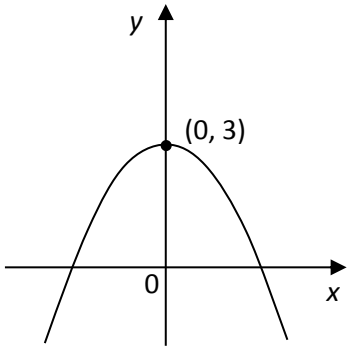
(c)



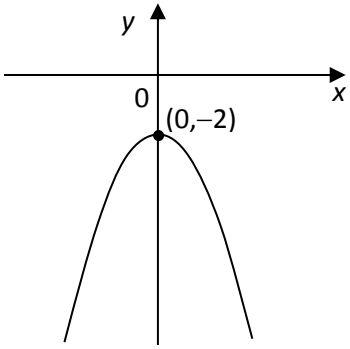
(d)



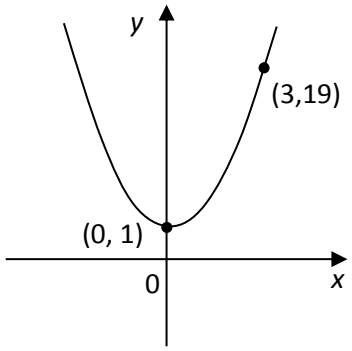
(e)



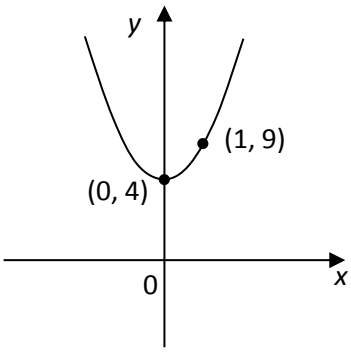
(f)



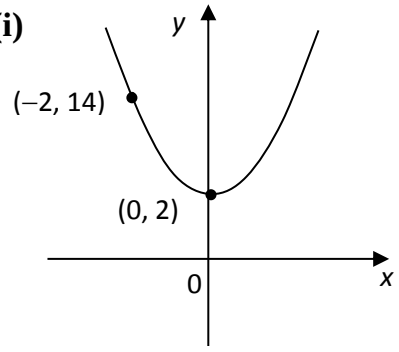
(g)



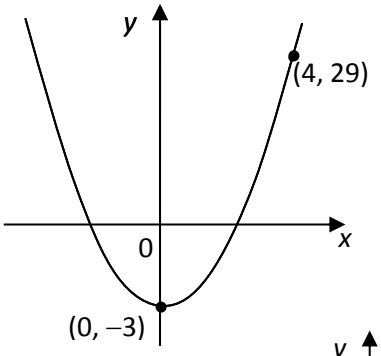
(h)



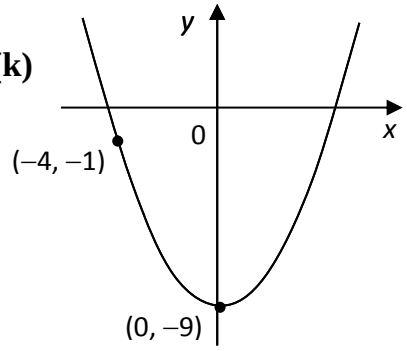
(i)



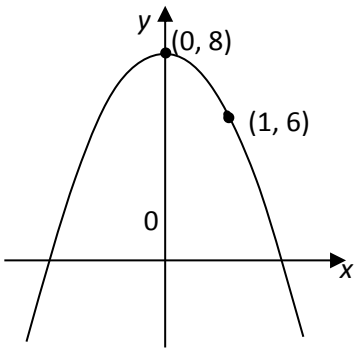
(j)



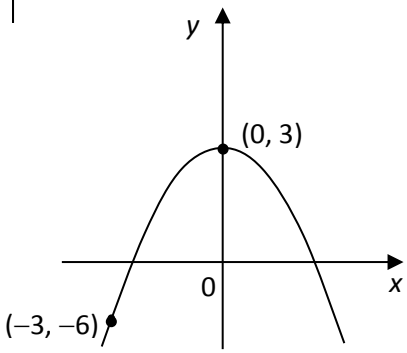
(k)



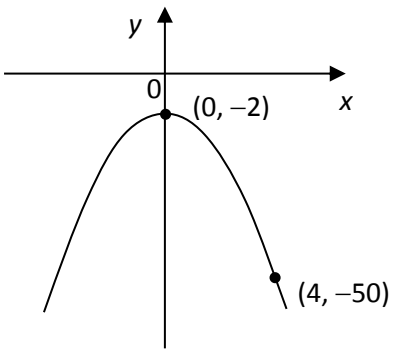
(l)



(m)

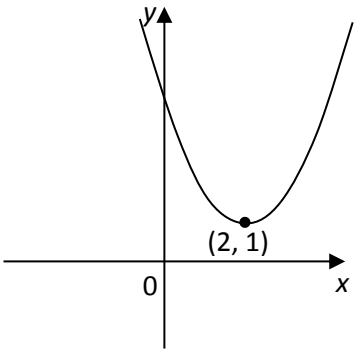


(n)

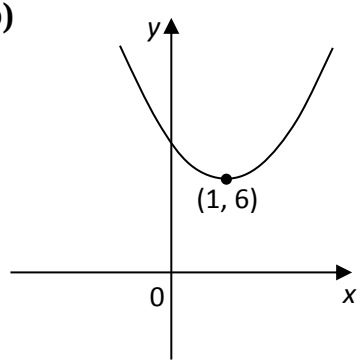


3. Write down the equation of the graphs shown below, which have the form $y = (x + a)^2 + b$.

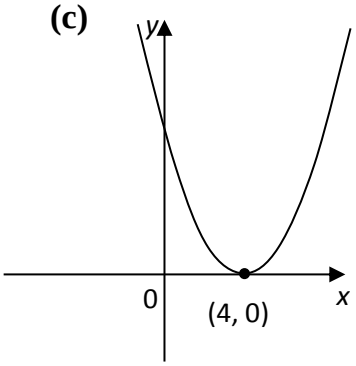
(a)



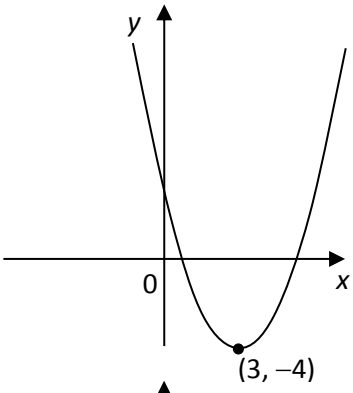
(b)



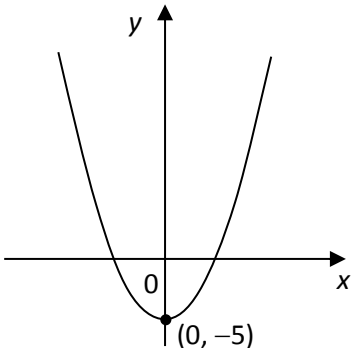
(c)



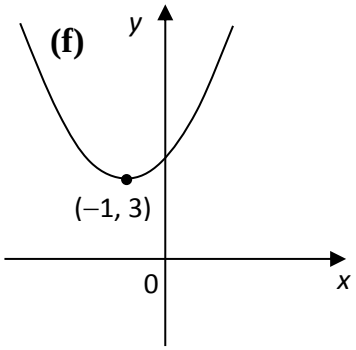
(d)



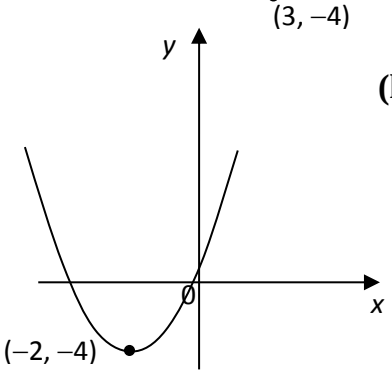
(e)



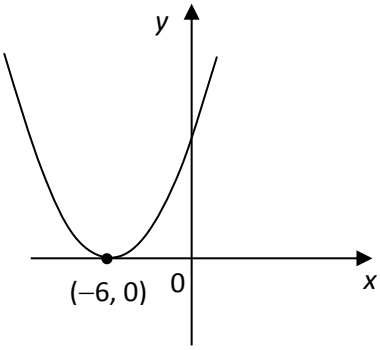
(f)



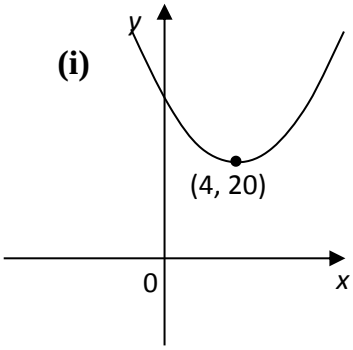
(g)



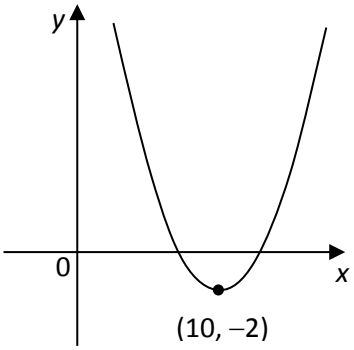
(h)



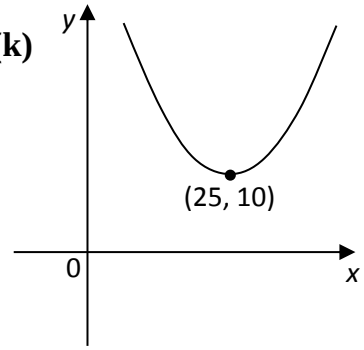
(i)



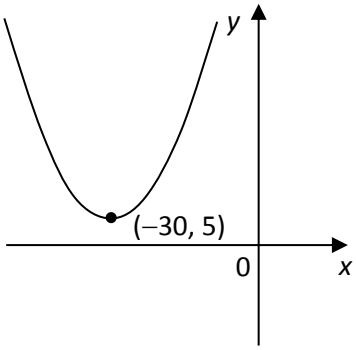
(j)



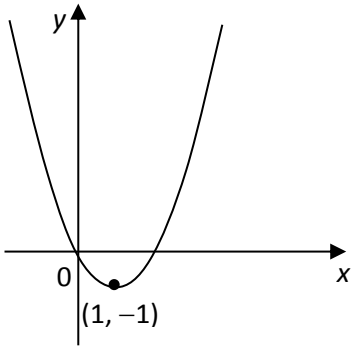
(k)



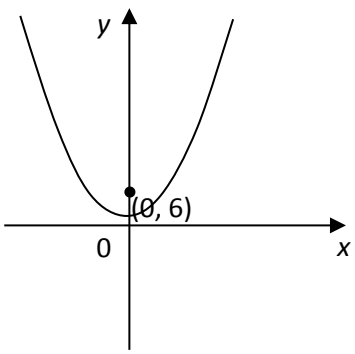
(l)



(m)



(n)



REL 2.2 SKETCHING the GRAPH of a QUADRATIC FUNCTION

1. Sketch the graphs with the following equations

(a)	$y = (x - 4)^2 + 1$	**(b)**	$y = (x - 2)^2 + 5$	**(c)**	$y = (x - 1)^2 + 7$
(d)	$y = (x - 2)^2 - 3$	**(e)**	$y = (x - 3)^2 - 4$	**(f)**	$y = (x - 5)^2 - 2$
(g)	$y = (x + 4)^2 + 6$	**(h)**	$y = (x + 1)^2 + 5$	**(i)**	$y = (x + 8)^2 + 1$
(j)	$y = (x + 3)^2 - 1$	**(k)**	$y = (x + ½)^2 - ¾$	**(l)**	$y = (x + 0{\cdot}5)^2 - 2{\cdot}5$
(m)	$y = -(x - 1)^2 + 4$	**(n)**	$y = -(x + 6)^2 + 3$	**(o)**	$y = -(x + 7)^2 - 2$
(p)	$y = (2 - x)^2 + 12$	**(q)**	$y = (5 - x)^2 - 1$	**(r)**	$y = (4 - x)^2 + 3{\cdot}75$

2. Sketch the graphs with the following equations

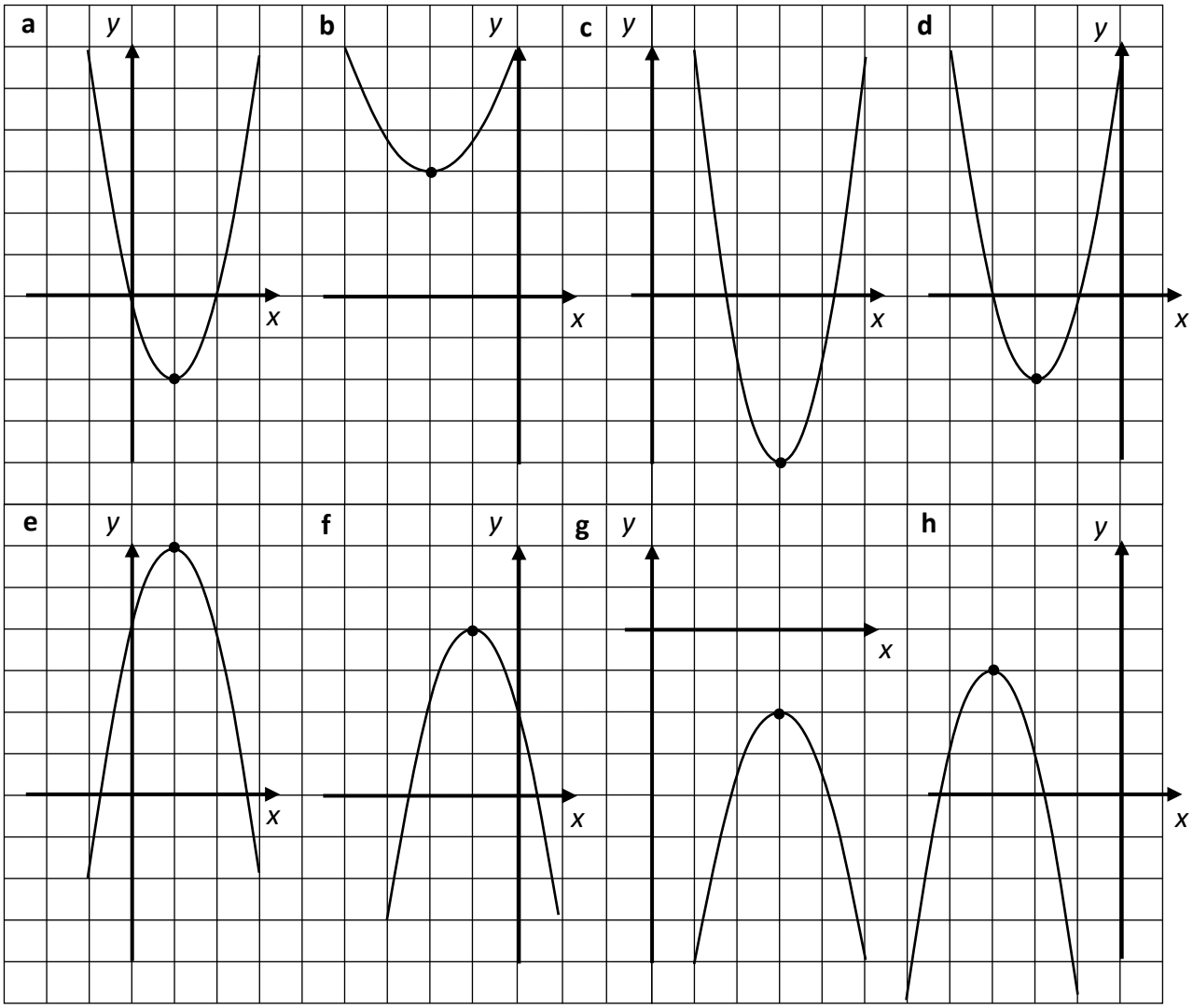
(a)	$y = (x - 1)(x - 5)$	**(b)**	$y = (x - 4)(x - 2)$	**(c)**	$y = (x - 3)(x - 7)$
(d)	$y = (x - 6)(x - 8)$	**(e)**	$y = (x - 5)(x - 2)$	**(f)**	$y = (x - 8)(x - 5)$
(g)	$y = (x + 2)(x + 3)$	**(h)**	$y = (x + 5)(x + 2)$	**(i)**	$y = (x + 4)(x + 6)$
(j)	$y = (x + 3)(x + 4)$	**(k)**	$y = (x + 9)(x + 5)$	**(l)**	$y = (x + 3)(x + 8)$

3. Sketch the graphs with the following equations

(a)	$y = (x - 1)(x + 5)$	**(b)**	$y = (3 + x)(7 - x)$	**(c)**	$y = -(3 + x)(5 - x)$
(d)	$y = -(x + 8)(x - 4)$	**(e)**	$y = (x + 1)(x - 7)$	**(f)**	$y = (1 + x)(7 - x)$
(g)	$y = -(x - 3)(x + 9)$	**(h)**	$y = (x - 10)(x + 2)$	**(i)**	$y = -(x - 9)(x + 7)$
(j)	$y = -(x + 4)(x - 6)$	**(k)**	$y = (1 + x)(1 - x)$	**(l)**	$y = (x + 2)(x - 6)$
(m)	$y = (x - 3)(x + 3)$	**(n)**	$y = -(x - 7)(x + 1)$	**(o)**	$y = -(x + 10)(x - 6)$

REL 2.3 IDENTIFYING FEATURES of a QUADRATIC FUNCTION

1. For each of the graphs below, write down **(i)** the turning point
(ii) its nature
and **(iii)** the equation of the axis of symmetry



2. For each of the equations below, write down **(i)** the turning point
(ii) its nature
and **(iii)** the equation of the axis of symmetry

(a)	$y = (x - 4)^2 + 1$	**(b)**	$y = (x - 2)^2 + 5$	**(c)**	$y = (x - 1)^2 + 7$
(d)	$y = (x - 2)^2 - 3$	**(e)**	$y = (x - 3)^2 - 4$	**(f)**	$y = (x - 5)^2 - 2$
(g)	$y = (x + 4)^2 + 6$	**(h)**	$y = (x + 1)^2 + 5$	**(i)**	$y = (x + 8)^2 + 1$
(j)	$y = (x + 3)^2 - 1$	**(k)**	$y = (x + ½)^2 - ¾$	**(l)**	$y = (x + 0{\cdot}5)^2 - 2{\cdot}5$
(m)	$y = -(x - 1)^2 + 4$	**(n)**	$y = -(x + 6)^2 + 3$	**(o)**	$y = -(x + 7)^2 - 2$
(p)	$y = (2 - x)^2 + 12$	**(q)**	$y = (5 - x)^2 - 1$	**(r)**	$y = (4 - x)^2 + 3{\cdot}75$

Answers 3(a)

APP 4.1 COMPARING DATA SETS

QUARTILES and INTERQUARTILE RANGE

1.

	median	Q1	Q3	SIR
(a)	7	4	12	8
(b)	33	30	37	7
(c)	22	19	25	6
(d)	2	0	3	3
(e)	4·0	2·8	5·1	2·3
(f)	0·275	0·185	0·305	0·12
(g)	139	136	142	6
(h)	382	376	387	11
(i)	67	59	83·5	24·5
(j)	14	11	16	5

2.

	median	Q1	Q3	SIR
(a)	56	50	61	11
(b)	26	16	34	18
(c)	165	152·5	169	16·5
(d)	3	1	4	3
(e)	128·5	115	157·5	42.5
(f)	63	50	70·5	20.5
(g)	180	166	187	21
(h)	346	317	363	46
(i)	0·9	0·6	1·1	0·5
(j)	11	10	13·5	3·5

STANDARD DEVIATION

1.

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
mean	20·3	302	14·99	87	62·8	4·45	0·23	39·6
SD	0·95	3·19	0·19	1·49	22·9	0·30	0·13	1·17

2. 3·44, 1·72

3. line A 27, 0·55; line B 27,0·19; line B more consistent

4. 106, 16·7

5. 21, 3·6

6. John 73, 1·04 ; Joe 72, 5·20 — Joe has lower mean score but John has better overall performance (lower standard deviation)

7. Dec 3313, 1025; Mar 2352, 565 — December has higher mean takings but March has less variation in takings

8. 6C1 21·5,1·26 ; 6C2 21·5, 2·88 — Same average but 6C1 has lower SD so less spread out.

APP 4.2 FORMING a LINEAR MODEL from a given SET of DATA

1. **(a)** no relation **(b)** positive **(c)** negative

2. **(a)** positive correlation (more rain – more people buy umbrellas)
(b) no relation
(c) negative correlation (the faster you go, the less time it takes)

3. **(a)** yes **(b)** yes, but not strong **(c)** yes **(d)** no

4. student's best fit lines

5. Answers will vary depending on where line is drawn
(a) $y = 1{\cdot}67x + 3.3$ **(b)** $y = 0{\cdot}4x + 1.5$ **(c)** $y = 1{\cdot}2x - 6$
(d) $y = -1{\cdot}5x + 9$ **(e)** $y = -1{\cdot}5x + 12$ **(f)** $y = -0{\cdot}25x + 7$

6. H = 0·6D + 0·7, 1·6

7. $y = 3{\cdot}8x + 6$

8. $l = 0{\cdot}9F + 2{\cdot}2$, 6·25

9. C = –2T + 67, 62°C

10. S = 7T, 70 mph

11. C = 1·1m + 177, £215.50

12. R = –0·35V + 0·61, 0·3

EXAM QUESTIONS

MEAN and STANDARD DEVIATION

1. **(a)** 40·7g, 3·6 **(b)** 140·7g, 3·6

2. **(a)** 7·55; 0·44 **(b)** slightly higher mean so slower times on average in 2nd race
higher SD so times are less consistent than 1st race

3. **(a)** 80kg, 12·2 **(b)** on average weight is less and less spread out

4. **(a)** 66; 6·56 **(b)** 71; 6·56

5. **(a)** 21·5; 4·42 **(b)** On average study times same but teachers are more varied

6. **(a)** £157, 51·3 **(b)** on average E-Pod more expensive and less spread out

7. **(a)** £22·50, 5·4 **(b)** prices of dolls are less spread out than teddies

FORMING a LINEAR MODEL from a given SET of DATA

1. **(a)** $P = 3W + 5$ **(b)** 6 points

2. Answers depend on line drawn

3. A – strong positive correlation.

4. **(a)** strong positive correlation **(b)** $I = 1/7C + 1$

5. **(a)** $R = ½h + 4$ **(b)** 15

REL 2.1 RECOGNISE and DETERMINE the EQNS of QUADRATICS from their GRAPHS

1. **(a)** $y = x^2$ **(b)** $y = 3x^2$ **(c)** $y = 5x^2$ **(d)** $y = 1 \cdot 5x^2$

(e) $y = 5x^2$ **(f)** $y = 3x^2$ **(g)** $y = -x^2$ **(h)** $y = -2x^2$

(i) $y = -5x^2$ **(j)** $y = \frac{1}{2}x^2$ **(k)** $y = \frac{1}{4}x^2$ **(l)** $y = \frac{1}{3}x^2$

(m) $y = 40x^2$ **(n)** $y = -25x^2$ **(o)** $y = -\frac{3}{4}x^2$

2. **(a)** $y = x^2 + 2$ **(b)** $y = x^2 - 1$ **(c)** $y = x^2 + 1 \cdot 5$ **(d)** $y = -x^2 + 5$

(e) $y = -x^2 + 3$ **(f)** $y = -x^2 - 2$ **(g)** $y = 2x^2 + 1$ **(h)** $y = 5x^2 + 4$

(i) $y = 3x^2 + 2$ **(j)** $y = 2x^2 - 3$ **(k)** $y = \frac{1}{2}x^2 - 9$ **(l)** $y = -2x^2 + 8$

(m) $y = -x^2 + 3$ **(n)** $y = -3x^2 - 2$

3. **(a)** $y = (x-2)^2 + 1$ **(b)** $y = (x-1)^2 + 6$ **(c)** $y = (x-4)^2$

(d) $y = (x-3)^2 - 4$ **(e)** $y = x^2 - 5$ **(f)** $y = (x+1)^2 + 3$

(g) $y = (x+2)^2 - 4$ **(h)** $y = (x+6)^2$ **(i)** $y = (x-4)^2 + 20$

(j) $y = (x-10)^2 - 2$ **(k)** $y = (x-25)^2 + 10$ **(l)** $y = (x+30)^2 + 5$

(m) $y = (x-1)^2 - 1$ **(n)** $y = x^2 + 6$

REL 2.2 SKETCHING a QUADRATIC FUNCTION

1. Graphs should show the following:

(a) Turning point (4, 1); minimum; y – intercept (0, 17)

(b) Turning point (2, 5); minimum; y – intercept (0, 9)

(c) Turning point (1, 7); minimum; y – intercept (0, 8)

(d) Turning point (2, –3); minimum; y – intercept (0, 1)

(e) Turning point (3, –4); minimum; y – intercept (0, 5)

(f) Turning point (5, –2); minimum; y – intercept (0, 23)

(g) Turning point (–4, 6); minimum; y – intercept (0, 22)

(h) Turning point (–1, 5); minimum; y – intercept (0, 6)

(i) Turning point (–8, 1); minimum; y – intercept (0, 65)

(j) Turning point (–3, –1); minimum; y – intercept (0, 8)

(k) Turning point (–½, –¾); minimum; y – intercept (0, –½)

(l) Turning point (–0·5, –2·5); minimum; y – intercept (0, –2·25)

(m) Turning point (1, 4); maximum; y – intercept (0, 3)

(n) Turning point (–6, 3); maximum; y – intercept (0, –33)

(o) Turning point (–7, –2); maximum; y – intercept (0, –51)

(p) Turning point (2, 12); minimum; y – intercept (0, 16)

(q) Turning point (5, –1); minimum; y – intercept (0, 24)

(p) Turning point (4, 3·75); minimum; y – intercept (0, 19·75)

2. Graphs should all be minimum T.P. and show the following points:

(a) (1, 0), (5, 0) and (3, –4)

(b) (2, 0), (4, 0) and (3, –1)

(c) (3, 0), (7, 0) and (5, –4)

(d) (6, 0), (8, 0) and (7, –4)

(e) (2, 0), (5, 0) and (3·5, –2·25)

(f) (5, 0), (8, 0) and (6·5, –2·25)

(g) (−2, 0), (−3, 0) and (−2·5, –0·25)

(h) (−2, 0), (−5, 0) and (−3·5, –2·25)

(i) (−4, 0), (−6, 0) and (−5, –1)

(j) (−3, 0), (−4, 0) and (−3·5, –0·25)

(k) (−9, 0), (−5, 0) and (−7, –4)

(l) (−8, 0), (−3, 0) and (−5·5, –6·25)

3. Graphs should show the following:

(a) (1, 0), (–5, 0), (–2, –9)**,** minimum **(b)** (7, 0), (–3, 0), (2, 25)**,** maximum

(c) (5, 0), (–3, 0), (1, 16)**,** minimum **(d)** (4, 0), (–8, 0), (–2, 36)**,** maximum

(e) (7, 0), (–1, 0), (3, –16)**,** minimum **(f)** (7, 0), (–1, 0), (3, 16)**,** maximum

(g) (3, 0), (–9, 0), (–3, 36)**,** maximum **(h)** (10, 0), (–2, 0), (4, –36)**,** minimum

(i) (–7, 0), (9, 0), (1, 64)**,** maximum **(j)** (6, 0), (–4, 0), (1, 25)**,** maximum

(k) (1, 0), (–1, 0), (0, 1)**,** maximum **(l)** (6, 0), (–2, 0), (2, –16)**,** minimum

(m) (3, 0), (–3, 0), (0, –9)**,** minimum **(n)** (7, 0), (–1, 0), (3, 16)**,** maximum

(o) (6, 0), (–10, 0), (–2, 64)**,** maximum

REL 2.3 IDENTIFYING FEATURES of a QUADRATIC FUNCTION

1. **(a)** (1, –2); minimum; $x = 1$ **(b)** (–2, 3); minimum; $x = –2$

(c) (3, –4); minimum; $x = 3$ **(d)** (–2, –2); minimum; $x = –2$

(e) (1, 6); maximum; $x = 1$ **(f)** (–1, 4); maximum; $x = –1$

(g) (3, –2); maximum; $x = 3$ **(h)** (–3, 3); maximum; $x = –3$

2. **(a)** (4, 1); minimum; $x = 4$ **(b)** (2, 5); minimum; $x = 2$

(c) (1, 7); minimum; $x = 1$ **(d)** (2, –3); minimum; $x = 2$

(e) (3, –4); minimum; $x = 3$ **(f)** (5, –2); minimum; $x = 5$

(g) (–4, 6); minimum; $x = –4$ **(h)** (–1, 5); minimum; $x = –1$

(i) (–8, 1); minimum; $x = –8$ **(j)** (–3, –1); minimum; $x = –3$

(k) $(-\frac{1}{2}, -\frac{3}{4})$; minimum; $x = -\frac{1}{2}$ **(l)** (–0·5, – 2·5); minimum; $x = –0·5$

(m) (1, 4); maximum; $x = 1$ **(n)** (–6, 3); maximum; $x = –6$

(o) (–7, –2); maximum; $x = –7$ **(p)** (2, 12); minimum; $x = 2$

(q) (5, –1); minimum; $x = 5$ **(r)** (4, 3·75); minimum; $x = 4$