

The line of best fit on a scattergraph is a straight line. This means that you can find the equation of a line of best fit

Once you have the equation, you can use the equation to estimate the value of y when you are told x (or vice versa). At National 5, you have to use the equation to get any marks (the question will say this). You <u>cannot</u> do it by "looking and guessing". Any answer without working will get zero marks, even if it happens to be correct.

Example 1 (2010 Intermediate 2 Exam Question) A scattergraph shows the taxi fare p pounds plotted against the distance travelled, m miles. A line of best fit has been drawn.

The equation of the line of best fit is $p = 2 + 1 \cdot 5m$. Use this equation to predict the taxi fare for a journey of 6 miles.



Solution

The journey is 6 miles, so m = 6. Using the equation, $p = 2 + 1 \cdot 5m$ $p = 2 + 1 \cdot 5 \times 6$ p = 11 miles

Example 2

The scattergraph shows the power of an industrial battery (*P*) after *t* hours of charging.

- (a) Find the equation of the line of best fit
- (b) Use your equation to estimate the power of a battery that has been charged for 60 hours.

Solution

(a) We use the usual method for y = mx + c (see page 34). On this occasion, since the letters *P* and *t* are being used, we will use P = mt + c.

The y intercept is 10, so c = 10.

Now choose two points on the line (not necessarily on the original scatter graph) to calculate the gradient.

Two points on the line are (0, 10) and (10, 30). Therefore the gradient is:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{30 - 10}{10 - 0} = \frac{20}{10}$$
$$= 2$$



The line of best fit has y-intercept 10 and gradient 2, so the equation is y = 2x + 10, or (using the correct letters for this question) P = 2t + 10.

Note we could also have used y-b=m(x-a) to obtain the same answer.

(b) We use our equation from part (a) and put the number from the question into it.

The question uses the number 60, so we use t = 60. P = 2t + 10 $= 2 \times 60 + 10$ = 130

Exercise 1

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



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



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
	1	1	1	1		1		1	1	1
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	(b)	x	1	2	3	4	5
	у	5	7	8	10	12		У	2	2.5	2.5	3.5	3
c)	x	6	7	8	9	10	(d)	x	1	2	3	4	5
-	у	1	2	4	4.5	6		У	8	6	5	4	2
e)	i					_	(f)	ĺ	-				•
_	X	1	2	3	4	5		X	5	6	/	8	9
	у	8	10	8	5	3		У	6	5.2	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 $1\frac{1}{2}$ days.
- 7. The table shows the results of an experiment.

x	1	2	3	4	5	6
у	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 (I)	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 (°C)	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 $2\frac{1}{2}$ 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.

Exercise 2

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.

Answers

Exercise 1

1.	a)	no relation		(b)	positiv	ve		(c)	negative
2.	a) b) c)	positive correl no relation negative corre	(more) (the fa	rain – r ster you	ellas) kes)				
3.	a)	yes (b)	yes, bu	t not st	rong	(c)	yes	(d)	no
4.	stude	nt's best fit lines							
5.	Answ a) d)	ers will vary dep y = 1.67x + 3. y = -1.5x + 9	pending 3	on who (b) (e)	ere line y = 0.2 y = -1	is draw $4x + 1.5$ 5x + 1	n 2	(c) (f)	$y = 1 \cdot 2x - 6$ $y = -0 \cdot 25x + 7$
6.	H = 0	$\cdot 6D + 0.7, 1.6$		7.	$y = 3 \cdot 8$	8x + 6			
8.	l = 0.9	$\partial F + 2.2, 6.25$		9.	$\mathbf{C} = -2$	2T + 67,	62°C		
10.	$\mathbf{S} = 7$	Г, 70 mph		11.	C = 1·	1m + 17	77, £21	5.50	

12. R = -0.35V + 0.61, 0.3

Exercise 2

- **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 + 15. a) $R = \frac{1}{2}h + 4$ (b) 15