



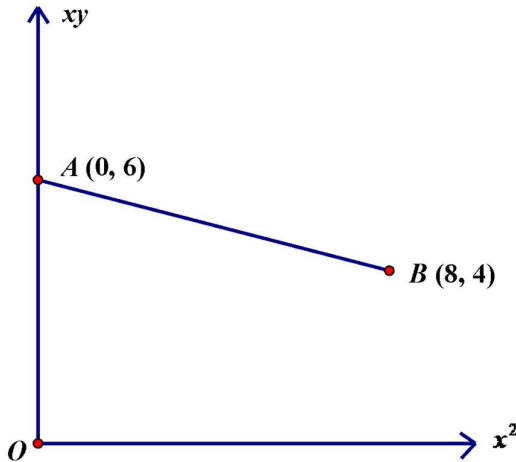
Name: _____ () Class: _____ Date: _____

Topical Revision Worksheet 7

Topic: Linear Law

Question 1 [2008 EOY, Q4]	marks												
Two variables x and y are such that when $\lg y$ is drawn against $\lg x$, a straight line of gradient -3 is obtained, passing through the point $(-2,9)$. (i) Express y in terms of x. $y = \left(\frac{10}{x}\right)^3$ Answer:	[4]												
(ii) Find the value of x when $y = -1$. Answer: $x = -10$	[2]												
Question 2 [2009 EOY, Q15]	marks												
Answer the whole of this question on a sheet of graph paper. The table shows experimental values of two variables, x and y, which are known to be related by the equation $y - 1 = px + \frac{q}{x}$. <table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>2.4</td><td>1.1</td><td>0.2</td><td>-0.5</td><td>-1.1</td></tr></table> (i) Choosing a suitable scale, plot $(xy - x)$ against x^2 and draw a straight line.	x	1	2	3	4	5	y	2.4	1.1	0.2	-0.5	-1.1	[5]
x	1	2	3	4	5								
y	2.4	1.1	0.2	-0.5	-1.1								
(ii) Use your graph to estimate the values of p and q. Answer: Fr graph, $q = 1.89$, $p = -0.493$	[2]												
(iii) Explain how you would use your graph to determine if the set of experimental values $x = 10$ and $y = -4$ are related by the equation $y - 1 = px + \frac{q}{x}$. Answer: $x^2 = 100$. Extend the line. If it passes through $(100, -50)$, then the values are related by the equation $y - 1 = px + \frac{q}{x}$.	[1]												

Question 3 [2010 EOY, Q8]		marks																
The table below shows experimental readings of y for given values of x such that $xy = ay + b\sqrt{x}$ where a and b are real constants. <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>y</td><td>0</td><td>2.21</td><td>1.96</td><td>-8.95</td><td>-3.88</td><td>-2.67</td><td>-2.11</td></tr></table> By drawing a straight line graph of $\sqrt{x}y$ against $\frac{y}{\sqrt{x}}$, identify the incorrect reading, Answer: From graph, the incorrect reading is 1.9		x	0	1	2	3	4	5	6	y	0	2.21	1.96	-8.95	-3.88	-2.67	-2.11	[4]
x	0	1	2	3	4	5	6											
y	0	2.21	1.96	-8.95	-3.88	-2.67	-2.11											
(ii) estimate the values of a and b. Answer: From the graph, $a = 2.4$ (1 d.p.) and $b \approx -3.2$ (1 d.p.)		[2]																
Question 4 [2012 EOY, Q12]		marks																
The table shows experimental values of two variables, x and y, which are known to be related by the equation $\sqrt{y}(x^b) = a$, where a and b are constants. <table><tr><td>x</td><td>1.0</td><td>1.5</td><td>2.0</td><td>2.5</td><td>3.0</td></tr><tr><td>y</td><td>7.3</td><td>3.5</td><td>2.0</td><td>1.3</td><td>0.9</td></tr></table> (i) Express this equation in a form suitable for drawing a straight line graph. Answer: $\lg y = -2b \lg x + 2 \lg a$		x	1.0	1.5	2.0	2.5	3.0	y	7.3	3.5	2.0	1.3	0.9	[2]				
x	1.0	1.5	2.0	2.5	3.0													
y	7.3	3.5	2.0	1.3	0.9													
(ii) Using a suitable scale, plot a straight line graph of $\lg y$ against $\lg x$. Use your graph to estimate the value of a and of b. Answer: $a = 2.69$ and $b = 0.915$		[6]																

Question 5 [2013 EOY, Q15]	marks																		
The table shows the experimental values of two variables x and y. <table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>3.8</td><td>11.2</td><td>20.5</td><td>33.2</td><td>50.6</td></tr><tr><td>$\frac{y}{x}$</td><td>3.8</td><td>5.6</td><td></td><td>8.3</td><td></td></tr></table> It is known that x and y are related by the equation $y = ax + bx^2$. Plot $\frac{y}{x}$ against x and draw a suitable straight line.	x	1	2	3	4	5	y	3.8	11.2	20.5	33.2	50.6	$\frac{y}{x}$	3.8	5.6		8.3		
x	1	2	3	4	5														
y	3.8	11.2	20.5	33.2	50.6														
$\frac{y}{x}$	3.8	5.6		8.3															
(a) Use the graph to estimate the (i) value of a and of b, Answer: The gradient $b = 1.6$ (± 0.2) and the vertical intercept is $a = 2.3$. (± 0.1)	[4]																		
(ii) the value of x when $y = 8x$. Answer: 3.6 (± 0.1)	[1]																		
(b) The diagram shows the straight line graph of xy against x^2 passing through the points $A(0, 6)$ and $B(8, 4)$. Express y in terms of x.  Answer: $y = -\frac{1}{4}x + \frac{6}{x}$ or $-\frac{x^2 + 24}{4x}$	[3]																		

Question 6 [2014 EOY, Q10]		marks														
Answer the whole of this question on a sheet of graph paper.		[4]														
The table shows experimental values of two variables x and y . It is known that x and y are related by an equation $y = ae^{-bx}$, and that one of these values of y given in the table is subject to an abnormally large error.																
<table border="1"><tr><td>X</td><td>1.5</td><td>2.5</td><td>3.5</td><td>4.5</td><td>5.0</td><td>6.0</td></tr><tr><td>Y</td><td>9.9</td><td>6.0</td><td>3.6</td><td>2.2</td><td>1.7</td><td>1.4</td></tr></table>		X	1.5	2.5	3.5	4.5	5.0	6.0	Y	9.9	6.0	3.6	2.2	1.7	1.4	
X	1.5	2.5	3.5	4.5	5.0	6.0										
Y	9.9	6.0	3.6	2.2	1.7	1.4										
(i) Draw a straight line graph of $\ln y$ against x , using a scale of 2 cm to 1 unit on the x -axis and 1 cm to 0.2 units on the $\ln y$ -axis.																
(ii) Use your graph to estimate the value of a and of b . $\ln a \approx 3.04 \Rightarrow a \approx 20.9$ (accept 20.0 to 21.8) Answer: $b \approx 0.500$ (accept 0.47 to 0.53)		[3]														
(iii) Identify the abnormal reading of y and estimate its correct value. Answer: The abnormal reading is 1.4. When $x = 6.0$, $\ln y$ is estimated to be 0.04. Hence, the correct value of $y \approx e^{0.04} \approx 1.04$. (accept 1.00 to 1.04)		[2]														
Question 7 [2015 EOY, Q8]		marks														
Answer the whole of this question on a sheet of graph paper.																
Two variables x and y are related such that $y^2 = ax^2 + bx$, where a and b are unknown constants. In an experiment, values of y are found for several values of x and the values are tabulated as shown below. It is also found that one particular value of y is incorrectly recorded.																
<table border="1"><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>y</td><td>2.07</td><td>3.77</td><td>5.45</td><td>6.81</td><td>8.81</td><td>10.48</td></tr></table>		x	1	2	3	4	5	6	y	2.07	3.77	5.45	6.81	8.81	10.48	
x	1	2	3	4	5	6										
y	2.07	3.77	5.45	6.81	8.81	10.48										
(i) Using a scale of 2 cm to 1 unit for the horizontal axis and 1 cm to 1 unit for the $\frac{y^2}{x}$ vertical axes, plot $\frac{y^2}{x}$ against x and draw a straight line graph, and use it to identify the incorrect value of y recorded.		[4]														
Answer: Incorrect value of y recorded is 6.81.																

- (ii) Use your graph to estimate, to one decimal place, the values of a and b , and hence estimate, to two decimal places, the correct value of y in (i).

[4]

Answer:

The gradient represents a , so $a \approx 2.8$ (accept $2.73 \leq a \leq 2.87$)

The vertical intercept represents b , so $b \approx 1.5$ (accept $1.3 \leq b \leq 1.7$)

$$\frac{y^2}{x} \approx 12.7 \Rightarrow y \approx 7.13$$

(accept $7.07 \leq y \leq 7.18$)