

## Revision Problems Using TI-89

1.	<table border="1"> <thead> <tr> <th>x</th> <th>y = ?</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>12</td> </tr> <tr> <td>7</td> <td>16</td> </tr> <tr> <td>10</td> <td>?</td> </tr> <tr> <td>?</td> <td>40</td> </tr> </tbody> </table>	x	y = ?	3	12	7	16	10	?	?	40	<p>Answer the question marks in case of a linear model.</p> <p>Answer the question marks in case of an exponential model. What is the doubling time?</p> <p>Answer the question marks in case of a power model.</p>				
x	y = ?															
3	12															
7	16															
10	?															
?	40															
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3.	<table border="1"> <thead> <tr> <th>x</th> <th>y = ?</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>12</td> </tr> <tr> <td>7</td> <td>16</td> </tr> <tr> <td>10</td> <td>14</td> </tr> <tr> <td>12</td> <td>18</td> </tr> <tr> <td>15</td> <td>?</td> </tr> <tr> <td>?</td> <td>30</td> </tr> </tbody> </table>	x	y = ?	3	12	7	16	10	14	12	18	15	?	?	30	<p>Answer the question marks in case of a cubic model.</p> <p>Find maxima and minima.</p> <p>Find the equation for the tangent line in <math>x=2</math>.</p> <p>Find the gradient formula.</p> <p>Find the gradient number in <math>x = 5</math></p> <p>Find the area formula</p> <p>Find the area number from <math>x= 1</math> to <math>x = 6</math></p> <p>Find the intersection points with the line <math>y = 3 + 2x</math></p>
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4.	$3x + 4y = 15$ & $5x - 6y = 12$	Solve the simultaneous equations														
5.	Given two points in a coordinate system P(2,4) and Q( 6,10)	<p>Find the midpoint of the line PQ.</p> <p>Find the equation for the line through P and Q</p> <p>Find the equation for the normal line to PQ passing through P</p> <p>Find the angle between PQ and the x-axis.</p> <p>Find the distance between P and Q</p> <p>Find the distance from the line PQ to the point S(8,1)</p> <p>Find the equation for the circle through P and Q and with the midpoint of PQ as centre.</p> <p>Find the intersection point between the circle and the line <math>y = 12-2x</math></p>														
6.		Find something to be happy about														
7.	Let X be a normal random variable with mean $m = 100$ and standard deviation $d = 12$	$P(X < 115) = [\text{CATALOG}, \text{F3}] \text{ normCdf} (-\infty, 115, 100, 12) = 0.894$ $P(X < 89) =$ $P(X > 108) =$ $P(93 < X < 109) =$														
8.	X counts the numbers of wins in 100 repetitions of a game with 65% winning chance.	$P(X < 70) = [\text{CATALOG}, \text{F3}] \text{ binomCdf} (100, .65, 0, 69) = 0.827$ $P(X \leq 60) =$ $P(X \geq 58) =$ $P(63 < X \leq 72) =$														
9.	$\sin(3x) = 0.4, \quad 0 \leq x \leq 2\pi$ $\cos(\frac{1}{2}x) = -0.3, \quad 0 \leq x \leq 2\pi$ $\tan(2x) = 0.7, \quad 0 \leq x \leq 2\pi$	<p>Find the solutions: <i>Remember to adjust the window</i></p> <p>Find the solutions:</p> <p>Find the solutions:</p>														
10.	$A = 40, b = 7, C = 90$	Find a, B and c.														
11.	$a = 4, c = 7, C = 90$	Find A, B and b.														
12.	$A = 40, b = 7, C = 68$	Find a, B and c.														
13.	$A = 40, b = 7, c = 6.8$	Find a, B and C.														
14.	$A = 40, b = 7, a = 6.2$	Find c, B and C.														
15.	$a = 4, b = 7, c = 6.8$	Find A, B and C.														
16.	$T = \frac{d}{e-f} + g$	Transpose the T-formula to a d-formula, e-formula, f-formula, g-formula														
17.	The capital 785 increased with 2.7% 5 times and became ?	<p>Find the answer</p> <p>Find the corresponding doubling time.</p>														
18.	The capital 785 increased with 2.7% ? times and became 980	<p>Find the answer</p> <p>Find the corresponding doubling time.</p>														
19.	The capital 785 increased with ?% 5 times and became 980	<p>Find the answer</p> <p>Find the corresponding doubling time.</p>														
20.	-22	As 17-19, but with \$ instead of %														

### Problem 1. Linear model

Equation:	$y=ax+b$ $y=x+9$ , found by data/matrix-editor, F5, linear regression
Test	$y x=3$ gives 12

$y=?$	$y=x+9$
$x=10$	$y=19$ found by $y(10)$
Test	$y=19$ found by Graph F5 value

$x=?$	$y=x+9$
$y=40$	$x=31$ found by F2, solve( $y1(x)=40,x$ )
Test	$y x=31$ gives 40

#### Exponential model

Equation:	$y=a*b^x$ $y=9.671*1.075^x$ found by data/matrix-editor, F5, exponential regression
Test	$y x=3$ gives 12

$y=?$	$y=9.671*1.075^x$
$x=10$	$y=19.853$ found by $y(10)$
Test	$y=19.853$ found by Graph F5 value

$x=?$	$y=9.671*1.075^x$
$y=40$	$x=19.740$ found by F2, solve( $y1(x)=40,x$ )
Test	$y x=19.740$ gives 40

Doubling time  $T = \log 2 / \log b = \log 2 / \log 1.075 = 9.6$

#### Power model

Equation:	$y=a*x^b$ $y=8.264*x^{0.340}$ found by data/matrix-editor, F5, power regression
Test	$y x=3$ gives 12

$y=?$	$y=8.264*x^{0.340}$
$x=10$	$y=18.060$ found by $y(10)$
Test	$y=18.060$ found by Graph F5 value

$x=?$	$y=8.264*x^{0.340}$
$y=40$	$x=104.024$ found by F2, solve( $y1(x)=40,x$ )
Test	$y x=104.024$ gives 40

### Problem 2. Quadratic model

Equation:	$y=a*x^2+b*x+c$ $y=-0.048x^2+1.476x+8$ found by data/matrix-editor, F5, quadratic regression
Test	$y x=3$ gives 12

$y=?$	$y=-0.048x^2+1.476x+8$
$x=15$	$y=19.429$ found by $y(15)$
Test	$y=19.429$ found by Graph F5 value

$x=?$	$y=-0.048x^2+1.476x+8$
$y=40$	$x=1.420$ or $29.580$ found by F2, solve( $y1(x)=40,x$ )
Test	$y x=1.420$ gives 40 $y x=29.580$ gives 40

Maximum:	$y=-0.048x^2+1.476x+8$  $(x,y) = (15.500, 19.140)$ found by graph, F5, maximum
Test	Solve( $dy/dx=0,x$ ) gives 15.5 $y x=15.5$ gives 19.14

Tangent	$y=-0.048x^2+1.476x+8$  $x=2$ $y=1.286x + 8.190$ found by graph, F5, tangent
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Gradient formula	$y=-0.048x^2+1.476x+8$  $y' = -0.095*x + 1.476$ found by F3, differentiate
Test	$ y' dx = -0.048x^2 + 1.476x$

Gradient number:	$y=-0.048x^2+1.476x+8$  $x=5$ $y'(5) = 1$ found by graph, F5, $dy/dx$
Test	$y' x=5$ gives 1

Area formula:	$y=-0.048x^2+1.476x+8$  $x=2$ $ y dx = -0.016*x^3 + 0.738*x^2 + 8.000*x$ found by F3, integrate
Test	$d( y dx)/dx = -0.048x^2 + 1.476x + 8$

Area number:	$y=-0.048x^2+1.476x+8$  $\int_1^6 y dx = 62.421$ found by F3, $\int(y1(x),x,1,6)$
Test	62.421, found by graph, F5, integrate

Intersection points	$y = -0.048x^2+1.476x+8$ and $y = 3+2x$
$x=5$	$(x,y) = (-17.130, -31.260)$ and $(x,y) = (6.130, 15.260)$ , found by F2, solve ( $y1(x) = 3+2x, x$ ) and $y1(x) x=-17.130$ etc.
Test	tested by graph, F5, intersection.

### Problem 3. Cubic model

Equation:	$y=a*x^3+b*x^2+c*x+d$  $y=0.086x^3-1.952x^2+13.752x-14$ found by data/matrix-editor, F5, quadratic regression
Test	$y x=3$ gives 12

$y=?$	$y=0.086x^3-1.952x^2+13.752x-14$
$x=15$	$y=42.286$ found by $y(15)$
Test	$y=42.286$ found by Graph F5 value

$x=?$	$y=0.086x^3-1.952x^2+13.752x-14$
$y=30$	$x=13.885$ found by F2, solve( $y1(x)=30,x$ )
Test	$y x=13.885$ gives 30

Maximum Minimum:	$y=0.086x^3-1.952x^2+13.752x-14$  Max: $(x,y) = (5.552, 16.841)$ found by graph, F5, maximum Min: $(x,y) = (9.634, 13.925)$ found by graph, F5, minimum
Test	Solve( $dy/dx=0,x$ ) gives 5.552 and 9.634 $y x=5.552$ gives 16.841 $y x=9.634$ gives 13.925

Tangent	$y=0.086x^3-1.952x^2+13.752x-14$  $x=2$ $y = 6.971x - 7.562$ found by graph, F5, tangent
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Gradient formula	$y=0.086x^3-1.952x^2+13.752x-14$  $y' = 0.257*x^2 - 3.905*x + 13.752$ , found by F3, differentiate
Test	$ y' dx = 0.086x^3 - 1.952x^2 + 13.752x$

Gradient number:	$y=0.086x^3-1.952x^2+13.752x-14$
$x=5$	$y'(5) = 0.657$ found by graph, F5, dy/dx
Test	$y' x=5$ gives 0.657

Area formula:	$y=0.086x^3-1.952x^2+13.752x-14$
$x=2$	$\int y dx = 0.021x^4 - 0.651x^3 + 6.876x^2 + 14x$ found by F3, integrate
Test	$d(\int y dx)/dx = 0.086x^3 - 1.952x^2 + 13.752x - 14$

Area number:	$y=0.086x^3-1.952x^2+13.752x-14$
	$\int_1^6 y dx = 58.496$ found by F3, $\int(y1(x),x,1,6)$
Test	58.496, found by graph, F5, integrate

Intersection points with  $y=3+2x$ :  $(x,y) = (2.129, -7.259)$  and  $(x,y) = (6.657, 16.315)$  and  $(x,y) = (13.991, 30.981)$  found by F2, solve  $(y1(x)=3+2x, x)$ , tested by graph, F5, intersection.

#### Problem4

Solutions:  $(x,y) = (3.632, 1.027)$ , found by F2, solve  $(3x+4y = 15$  and  $5x-6y = 12, \{x,y\})$ .

Tested by  $A*B=C$ ,  $B=A^{-1}*C = \begin{pmatrix} 3.632 \\ 1.027 \end{pmatrix}$ , hvor  $A = \begin{pmatrix} 3 & 4 \\ 5 & -6 \end{pmatrix}$  og  $B = \begin{pmatrix} x \\ y \end{pmatrix}$  og  $C = \begin{pmatrix} 15 \\ 12 \end{pmatrix}$ .

#### Problem5

Midpoint:	$(x,y) = (\frac{x1+x2}{2}, \frac{y1+y2}{2})$
$x1=2$ $x2=6$ $y1=4$ $y2=10$	$(x,y) = (4,7)$ found by $(\frac{x1+x2}{2}, \frac{y1+y2}{2}) x1=2$ and $x2=6$ and $y1=4$ and $y2=10$
Test	Tested geometrically

Gradient PQ:	$a = \frac{y2-y1}{x2-x1}$
$x1=2$ $x2=6$ $y1=4$ $y2=10$	$a = 3/2$ found by $\frac{y2-y1}{x2-x1} x1=2$ and $x2=6$ and $y1=4$ and $y2=10$
Test	Tested geometrically

Line PQ:	$y = y1 + a*(x - x1)$
$a=3/2$ $x1=2$ $y1=4$	$y = 1.5*x + 1$ found by $y2 + a*(x - x2) x1=2$ and $y1=4$ and $a=1.5$
Test	Tested geometrically

Gradient perpend.:	$c*a = -1$
$a=3/2$	$c = -2/3$ found by solve( $c*3/2 = -1, c$ )
Test	Tested geometrically

Normal:	$y = y1 + a*(x - x1)$
$a=-2/3$ $x1=2$ $y1=4$	$y = -2/3*x + 5.333$ found by $y2 + a*(x - x2) x1=2$ and $y1=4$ and $a=-2/3$
Test	Tested geometrically

Distance PQ	$d = \sqrt{(x2-x1)^2 + (y2-y1)^2}$
$x1=2$ $x2=6$ $y1=4$ $y2=10$	$d = 7.21$ found by $\sqrt{(x2-x1)^2 + (y2-y1)^2} x1=2$ and $x2=6$ and $y1=4$ and $y2=10$
Test	Tested geometrically

Distance point-line	$d = \frac{ c2 - a*c1 - b }{\sqrt{1 + a^2}}$
$a=1.5$ $b=1$ $x1=8$ $y1=1$	$d = 6.66$ found by $d = \frac{ c2 - a*c1 - b }{\sqrt{1 + a^2}} x1=8$ and $y1=1$ and $a=1.5$ and $b=1$
Test	Tested geometrically

Circle equation	$(x-c1)^2 + (y - c2)^2 = r^2$
$r=1/2*7.21$ $r=3.61$ $c1=4$ $c2=7$	$(x-4)^2 + (y-7)^2 = 13.03$ found by $(x-c1)^2 + (y-c2)^2 = r^2 c1=4$ and $c2=7$ and $r=3.61$
Test	$(7.61-4)^2 + (7-7)^2 = 13.03$ $13.03 = 13.03$

Intersection	$(x-c1)^2 + (y - c2)^2 = r^2$ and $y = 12-2x$
$r=1/2*7.21$ $=3.61$ $c1=4$ $c2=7$	$(x,y) = (1.30, 9.40)$ and $(4.30, 3.40)$ found by solve( $(x-4)^2 + (y-7)^2 = 13.03, x$ )  $y=12-2x$
Test	Tested geometrically

Angle:  $\tan(v) = a, a=3/2$ ;  $v = 56.31$  found by solve( $\tan v = 3/2, v$ ) | $v > 0$  and  $v < 90$ . Tested geometrically

#### Problem7

$p(X < 115) = 0.894$ , found by normCdf(-∞, 115, 100, 12)
$p(X < 89) = 0.180$ , found by normCdf(-∞, 89, 100, 12)
$p(X > 108) = 0.253$ , found by normCdf(108, ∞, 100, 12)
$p(93 < X < 109) = 0.494$ , found by normCdf(93, 109, 100, 12)

#### Problem8

$p(X < 70) = 0.827$ , found by binomCdf(100, 0.65, 0, 69)
$p(X \leq 60) = 0.172$ , found by binomCdf(100, 0.65, 0, 60)
$p(X \geq 58) = 0.941$ , found by binomCdf(100, 0.65, 58, 100)
$p(63 < X \leq 72) = 0.571$ , found by binomCdf(100, 0.65, 64, 72)

#### Problem9

$x=?$	$\sin(3x) = 0.4$
	$X = 0.137$ , or $0.910$ , or $2.232$ or $3.004$ or $4.326$ or $5.099$ found by solve( $\sin(3x)=0.4, x$ )   $x > 0$ and $x < 2\pi$
Test	$\sin(3x) x=0.137$ gives 0.4 etc.

$x=?$	$\cos(1/2x) = -0.3$
	$X = 3.745$ found by solve( $\cos(1/2x)=-0.3, x$ )   $x > 0$ and $x < 2\pi$
Test	$\cos(1/2x) x=3.745$ gives -0.3

$x=?$	$\tan(2x) = 0.7$
	$X = 0.305$ , or $1.876$ , or $3.447$ or $5.018$ found by solve( $\cos(1/2x)=-0.3, x$ )   $x > 0$ and $x < 2\pi$
Test	$\tan(2x) x=0.305$ gives 0.37 etc.

#### Problem 10

$a=?$	$\tan A = a/b$
$A=40$ $b=7$	$a = 5.874$ found by solve( $\tan 40 = a/7, b$ )
Test	$\tan 40 = 5.874/7$ $0.839 = 0.839$

$c=?$	$\cos A = b/c$
$A=40$ $b=7$	$c = 9.138$ found by solve( $\cos 40 = 7/c, c$ )
Test	$\cos 40 = 7/9.138$ $0.766 = 0.766$

$B=?$	$A + B = 90$
$A=40$	$B = 50$ found by solve( $40+B=90, B$ )
Test	$50+40 = 90$ $90 = 90$

**Problem 11**

b = ?	$a^2 + b^2 = c^2$
a = 4	b = 5.745
c = 7	found by solve( $4^2 + b^2 = 7^2, b$ )
Test	$4^2 + 5.745^2 = 7^2$ 49 = 49

A = ?	$\sin A = b/c$
a = 4	A = 34.85
c = 7	found by solve( $\sin A = 4/7, A$ )
Test	$\sin 34.85 = 4/7$ 0.571 = 0.571

B = ?	A + B = 90
A =	B = 55.15
34.85	found by solve( $34.85 + B = 90, B$ )
Test	$34.85 + 55.15 = 90$ 90 = 90

**Problem 12**

B = ?	A + B + C = 180
A = 40	B = 72
C = 68	found by solve( $40 + B + 68 = 180, B$ )
Test	$40 + 72 + 68 = 180$ 180 = 180

a = ?	$a/\sin A = b/\sin B$
A = 40	a = 4.731
B = 72	found by solve( $a/\sin 40 = 7/\sin 72, a$ )
b = 7	
Test	$4.731/\sin 40 = 7/\sin 72$ 7.360 = 7.360

c = ?	$c/\sin C = b/\sin B$
C = 68	c = 6.824
B = 72	found by solve( $c/\sin 68 = 7/\sin 72, c$ )
b = 7	
Test	$6.824/\sin 68 = 7/\sin 72$ 7.360 = 7.360

**Problem 13**

a = ?	$a^2 = c^2 + b^2 - 2*c*b*\cos A$
A = 40	a = 4.724
c = 6.8	found by
b = 7	solve( $a^2 = 6.8^2 + 7^2 - 2*6.8*7*\cos 40, a$ )
Test	$4.724^2 = 6.8^2 + 7^2 - 2*6.8*7*\cos 40$ 22.316 = 22.316

B = ?	$a/\sin A = b/\sin B$
A = 40	B = 72.3
b = 7	found by
a = 4.724	solve( $4.724/\sin 40 = 7/\sin B, B$ )
Test	$4.724/\sin 40 = 7/\sin 72.3$ 7.348 = 7.348

C = ?	A + B + C = 180
A = 40	C = 67.7
B = 72.3	found by
	solve( $40 + 72.3 + C = 180, C$ )
Test	$40 + 72.3 + 67.7 = 180$ 180 = 180

**Problem 14**

B = ?	$a/\sin A = b/\sin B$
A = 40	B = 46.53 or B = 133.47
a = 6.2	found by
b = 7	solve( $6.2/\sin 40 = 7/\sin B, B$ )   B > 0 and B < 180
Test	$6.2/\sin 40 = 7/\sin 46.53 = 7/\sin 133.47$ 9.645 = 9.645 = 9.645

C = ?	A + B + C = 180
A = 40	C = 93.47 or C = 6.53
B = 46.53	found by
or	solve( $40 + B + C = 180, C$ )
B = 133.47	
Test	$40 + 46.53 + 93.47 = 180$ 180 = 180

c = ?	$a/\sin A = c/\sin C$
A = 40	c = 9.628 or C = 1.097
a = 6.2	found by
C = 93.47	solve( $6.2/\sin 40 = c/\sin C, c$ )
or	
C = 6.53	
Test	$6.2/\sin 40 = 9.628/\sin 93.47 = 9.628/\sin 6.53$ 9.645 = 9.645 = 9.645

**Problem 15**

A = ?	$a^2 = c^2 + b^2 - 2*c*b*\cos A$
a = 4	A = 33.66
c = 6.8	found by solve( $4^2 = 6.8^2 + 7^2 - 2*6.8*7*\cos A, A$ )
b = 7	
Test	$4^2 = 6.8^2 + 7^2 - 2*6.8*7*\cos 33.66$ 16 = 16

B = ?	$b^2 = a^2 + c^2 - 2*a*c*\cos B$
a = 4	B = 75.91
c = 6.8	found by solve( $7^2 = 4^2 + 6.8^2 - 2*6.8*4*\cos B, B$ )
b = 7	
Test	$7^2 = 4^2 + 6.8^2 - 2*6.8*4*\cos 75.91$ 49 = 49

C = ?	A + B + C = 180
A = 33.66	C = 70.43
B = 75.91	found by
	solve( $33.66 + 75.91 + C = 180, C$ )
Test	$33.66 + 75.91 + 70.43 = 180$ 180 = 180

**Problem 16**

d = ?	$T = \frac{d}{e-f} + g$
	d = (e-f)*t - (e-f)*g
	found by
	solve( $T = \frac{d}{e-f} + g, d$ )
Test	Solve( $d = (e-f)*t - (e-f)*g, t$ ) gives $T = \frac{d}{e-f} + g$

e = ?	$T = \frac{d}{e-f} + g$
	$e = \frac{f*t + d - f*g}{t-g}$
	found by
	solve( $T = \frac{d}{e-f} + g, e$ )
Test	Solve( $e = \frac{f*t + d - f*g}{t-g}, t$ ) gives $T = \frac{d}{e-f} + g$

f = ?	$T = \frac{d}{e-f} + g$
	$f = \frac{e*t - d - e*g}{t-g}$
	found by
	solve( $T = \frac{d}{e-f} + g, f$ )
Test	Solve( $f = \frac{e*t - d - e*g}{t-g}, t$ ) gives $T = \frac{d}{e-f} + g$

g = ?	$T = \frac{d}{e-f} + g$
	$g = \frac{(e-f)*t - d}{e-f}$
	found by
	solve( $T = \frac{d}{e-f} + g, g$ )
Test	Solve( $g = \frac{(e-f)*t - d}{e-f}, t$ ) gives $T = \frac{d}{e-f} + g$

**Problems 17-19**

y = ?	$y = a*b^x$
a = 785	y = 896.85
b = 1.027	found by
x = 5	solve( $y = 785*1.027^x, y$ )
Test	$785*1.027^5$ gives 896.85
	$T = \ln(2)/\ln(1.027) = 26.0$

x = ?	$y = a*b^x$
a = 785	x = 8.3
b = 1.027	found by
y = 980	solve( $980 = 785*1.027^x, x$ )
Test	$785*1.027^x   x = 8.3$ gives 980
	$T = \ln(2)/\ln(1.027) = 26.0$

b = ?	$y = a*b^x$
a = 785	b = 1.045 = 1 + 4.5%
y = 980	found by solve( $980 = 785*b^5, b$ )
x = 5	
Test	$785*b^5   b = 1.045$ gives 980
	$T = \ln(2)/\ln(1.045) = 15.7$

**Problems 20-22**

y = ?	$y = a*x + b$
b = 785	y = 798.5
a = 2.7	found by
x = 5	solve( $y = 2.7*5 + 785, y$ )
Test	$2.7*5 + 785$ gives 798.5

x = ?	$y = a*x + b$
b = 785	x = 72.2
a = 2.7	found by solve( $980 = 2.7*x + 785, x$ )
y = 980	
Test	$2.7*x + 785   x = 72.2$ gives 980

a = ?	$y = a*x + b$
b = 785	a = 39
y = 980	found by solve( $980 = a*5 + 785, a$ )
x = 5	
Test	$2.7*x + 785   a = 39$ gives 980