GDC REVISION for MATH SL
for the CASIO model
by Christos Nikolaidis

From [MENU] we use

A. RUN-MAT
B. EQUA
C. STAT
D. GRAPH
E. RECUR (for sequences)

- **Remember**
  - to use **RAD** or **DEG** appropriately in SETUP (shift-menu)
  - in STAT – CALC to SET the first two lines
    LIST1-LIST2 if you have frequencies
  - in STAT – DIST we select
    Data : **Variable** instead of List
    For **NORMAL** we use ~~Npd~~ – **Ncd – InvN** (never Npd)
    For **BINOM** we use **Bpd – Bcd** – ~~InvB~~ (never InvB)
  - in SETUP (shift-menu) select Derivative On

- **Common mistakes**

For $x-3$ we must use the difference – and not the symbol (-)

For $\sin^2 x$ we must write $(sinx)^2$

For $sin3(x-2)$ we must write $\sin(3(x-2))$

In calculus, when we deal with sin, cos etc we must use **rad**

A. EXAMPLES FOR RUN-MAT

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1. Use **[MATH]** to find the following

(a) $\log_2 5$

(b) $f'(2)$ and $f''(2)$ (by using $\frac{d}{dx}$ and $\frac{d^2}{dx^2}$) for

$$f(x) = \frac{2x+5}{3x-7}$$

(c) the definite integral

$$\int_3^5 \frac{2x+5}{3x-7}dx$$

(d) the sum

$$\sum_{k=7}^{20} \frac{2k+5}{3k-7}$$

(e) the sum of the multiples of 7 between 1 and 200

Answers

(a) 2.32 (b) -29 and -174 (c) 5.80 (d) 14.07

(e) Since 200/7=28.6 and the multiples of 7 have the form 7x:

$$\sum_{x=1}^{28} 7x = 2842$$

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2. Use **[OPTION]** and **[PROB]** to find (a) 12! (b) $\binom{12}{5}$

Answers

(a) 479001600 (b) 792

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3. Use **[OPTION]** and **[NUM]-[Abs]** to find

(a) the definite integral

$$\int_3^5 |t^2 - 16|\, dt$$

(b) the sum

$$\sum_{k=1}^{30} |100 - 6k|$$

Answers

(a) 8 (b) 1358

4. Use **[OPTION] – [CALC] – [SolveN]** to solve the equations

(a) $e^x = 2x + 3$
(b) $sin3x = 0.5 \qquad 0 \leq x \leq \pi$
(c) $sin3x = 0.5 \qquad 0^o \leq x \leq 180^o$

Answers

(a) SolveN($e^x = 2x + 3$) gives: -1,37, 1,92

Notice: We can add a restriction for the domain. Use rad or degrees appropriately:

(b) SolveN($sin3x = 0.5$, x, $0, \pi$) gives: $\pi/18$, $5\pi/18$, $13\pi/18$, $17\pi/18$
(c) SolveN($sin3x = 0.5$, x, 0,180) gives: 10, 50, 130, 170

B. EXAMPLES FOR EQUA

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5. Use **[F2:Polynomial]** to solve $x^3 - 5x^2 + 3x + 6 = 0$

Answer

3.79, 2, -0.791

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6. Use **[F1:Simultaneous]** to solve the simultaneous equations

$$3x + 5y = 18$$
$$7x - 4y = -5$$

Answer

$x = 1, y = 3$

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7. Use **[F1:Simultaneous]** to solve the simultaneous equations

$$3a + 6b - c = 19$$
$$a - 2b + 4c = 3$$
$$7a - 13c = -19$$

Answer

$a = 1, b = 3, c = 2$

C. EXAMPLES FOR STAT

8. STATISTICS: Use **[STAT]** – **[CALC] – [SET] – [VAR1]**

A. Consider the data

2, 5, 7, 5, 3, 2, 5, 1, 7, 9

to find the following:

Mean = **4.6**	Range = max-min = **9-1 =8**
Median = **5**	Interquartile range = Q3 – Q1 = **7-2=5**
Mode = **5**	Standard deviation = σ = **2.458**
Lower quartile = Q1 = **2**	Variance = σ^2 = $\mathbf{(2.458)^2 = 6.04}$
Upper quartile = Q3 = **7**	

B. Consider the frequency table

x	10	20	30	40
frequency	3	5	7	5

to find the following:

Mean = **27**	Range = max-min = **40-10=30**
Median = **30**	Interquartile range = Q3 – Q1 = **35-20=15**
Mode = **30**	Standard deviation = σ = **10.05**
Lower quartile = Q1 = **20**	Variance = σ^2 = $\mathbf{(10.05)^2 = 101}$
Upper quartile = Q3 = **35**	

C. Consider the frequency table with intervals

x	5-15	15-25	25-35	35-45
frequency	3	5	7	5

Use the midpoints (i.e. exactly the same data as above) to find:

Mean = **27**	Standard deviation = σ = **10.05**
Modal group = **25-35**	Variance = σ^2 = $\mathbf{(10.05)^2 = 101}$

Notice:

For Q1,Median,Q3 we do not use the GDC. We need the cumulative frequency graph

9. REGRESSION: Use **[STAT]** – **[CALC] – [REG] – [F1] – [F1]**

Consider the table of **two** variables

x	10	20	30	40
y	112	185	250	432

Find the following

Correlation coefficient:	r = **0.966** (i.e. strong positive correlation between x and y)
Regression line:	y=**10.25**x **– 11.5**
Prediction for x=35:	y = 10.25×35 – 11.5 = 347.25

10. BINOMIAL DISTRIBUTION: Use **[STAT]** – **[DIST] – [BINM]**

The probability to win a game is 0.3

We play the game 12 times. So it is B(n,p) with n=12 and p=0.3

Find the following probabilities

To win	Math expression	GDC	Result
exactly 5 times	$P(X = 5)$	**Bpd(5)**	0.158
at most 5 times	$P(X \leq 5)$	**Bcd(0–5)**	0.882
at least 5 times	$P(X \geq 5)$	**Bcd(5–12)**	0.276
less than 5 times	$P(X < 5)$	**Bcd(0–4)**	0.724
more than 5 times	$P(X > 5)$	**Bcd(6–12)**	0.118
	$P(3 < X \leq 8)$	**Bcd(4–8)**	0.506

Remark; Bcd(5-12) denotes Lower: 5, Upper: 12

11. NORMAL DISTRIBUTION: Use **[STAT] – [DIST] – [NORM]**

PROBLEM 1: FIND PROBABILITY so use **[Ncd]**

If mean is **μ=1000** and standard deviation is **σ=50. Find the probability**

That X is	Math notation	GDC	Result
Between 900 and 1035	$P(900 < X < 1035)$	Ncd(900–1035)	**0.735**
More than 1035	$P(X > 1035)$	Ncd(1035–999999)	**0.242**
Less than 900	$P(X < 900)$	Ncd(-99999–900)	**0.0228**
Exactly 975	$P(X = 975)$	**0 (“exactly” is always 0)**	

PROBLEM 2: PROBABILITY IS GIVEN so use **[InvN]**

If mean is **μ=1000** and standard deviation is **σ=50**

It is given	Find	Math notation	GDC	Result
Prob less than ***a*** is 0.35	***a***	$P(X < \boldsymbol{a}) = 0.35$	**InvN** **Tail: Left, Area: 0.35**	***a*** =**981**
42% is more than ***b***	***b***	$P(X > \boldsymbol{b}) = 0.42$	**InvN** **Tail: Right, Area: 0.42**	***b***=**1010**
	Q1 **Q3**	$P(\mathrm{Q1} < X < \mathrm{Q3}) = 0.5$	**InvN** **Tail: Central, Area: 0.5**	Q1=**966** Q3=**1034**

PROBLEM 3: ***μ*** or ***σ*** or both are unknown so use the formula **Z=(X-μ)/σ** and **[InvN]**

Suppose that $\boldsymbol{\mu = 800}$ and ***σ*** is unknown

The information given can be expressed in different ways:

- The probability that X is less than **785** is **0.37**
- **37%** is less than **785**
- $P(X < \mathbf{785}) = \mathbf{0.37}$

Answer: We use the formula

$$\boldsymbol{Z = \frac{X - \mu}{\sigma}}$$

Right hand side: we know $X = 785$, $\mu = 800$

Left hand side: Z is obtained by the GDC:

InvN

Tail: Left

Area=0.37

***σ*=1**

***μ*=0**

$Z = -0.332$ and hence $\sigma = 45.18$

D. EXAMPLES FOR GRAPH

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12. Let $f(x) = -x^2 + 3x + 6$

(a) Solve $f(x) = 0$

(i) by using [EQUA]

(ii) by using [SolveN]

(iii) by using [Graph]

(b) Solve $f(x) > 0$

by using [Graph] (only)

(c) Find the range of f

by using [Graph]

(d) Find the area of the region R enclosed by the curve $y = f(x)$ and the x-axis

(i) by using [MATH]

(ii) by using [GRAPH]

(e) Find the volume generated when the region R is rotated 2π rad in x-axis

by using [MATH] (only)

Answer

(a) $-1.372, 4.372$ (b) $-1.372 < x < 4.372$ (c) $y \leq 8.25$ (d) 31.595 (e) 655.1

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13. Let $g(x) = 2x^3 - 15x^2 + 7x + 25$

(a) Solve $g(x) = 0$

(i) by using [EQUA]

(ii) by using [SolveN]

(iii) by using [Graph]

(b) Solve $g(x) > 0$

by using [Graph]

(c) Find the range of g

by using [Graph]

(d) Find the range of g if the domain is restricted to $-2 \leq x \leq 8$

by using [Graph]

(e) Find the area of the region R enclosed by the curve $y = f(x)$ and the x-axis

(i) by using [MATH]

(ii) by using [GRAPH]

Answer

(a) $-1.023, 1.824, 6.699$ (b) $-1.023 < x < 1.824$, $x > 6.699$ (c) $y \epsilon R$

(d) $-65.84 \leq y \leq 145$ (e) $48.448 + 204.081 = 252.529$ (or directly the result)

14. Suppose that the **velocity** of moving body in terms of time is given by

$$v = 2t^3 - 15t^2 + 7t + 25$$

Use the graph of g above (exercise 13) to find

(a) The velocity after 5 minutes

(b) The time at which the velocity is minimum

(c) The times when the direction changes

(d) the displacement from the initial position in the first 5 seconds

(e) the distance traveled in the first 5 seconds

Answer

(a) -65 (b) $t = 4.75$ (c) $t = 1.824, t = 6.699$ (positive roots)

(d) -100 (e) $32.437 + 132.436 = 164.873$ (or directly the result)

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15. Let $f(x) = -x^2 + 3x + 6$ and $g(x) = 2x^3 - 15x^2 + 7x + 25$

(a) Solve $f(x) = g(x)$

   (i) by using [SolveN]

   (ii) by using [Graph]

(b) Solve $f(x) > g(x)$ only by using graphs:

   (i) by using two graphs

   (ii) by using one graph only [i.e. $f(x) - g(x)$]

(c) Find the area enclosed by the two curves

Answer

(a) $-0.9733, 1.51, 6.463$ (b) $x < -0.9733,\ \ 1.51 < x < 6.463$

(c) 232.51

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16. Let $f(x) = x^2 e^{0.002x} sin0.3x$

Find the tangent line and the normal line at $x = 2$

Answer

You can use **[Graph] – [F4:Sketch]** – **[Tang] or [Norm]**

Remember to [SETUP] – Derivative on

We find <u>all</u> the details below as well as the final answers

Point $(2\ ,2.268)$, $m_T = 3.2665$, $m_N = -0.306$

Tangent line: $y - 2.268 = 3.2665\,(x - 2)$ or $y = 3.2665x - 4.2654$

Normal line: $y - 2.268 = -0.306\,(x - 2)$ or $y = -0.306x + 2.8798$

E. EXAMPLES FOR RECUR

17. SEQUENCES: Use **[RECUR]**

Consider the sequence

10,13,16,19,…

(a) Find the 50th term
(b) Find the sum of the first 50 terms
(c) Find the first term that exceeds 200
(d) Find the number of terms which are less than 200
(e) Find the sum of the terms which are less than 200

Answer

The general term of this arithmetic sequence is $u_n = 10 + (n-1) \times 3$

Use the following settings

[F3:TYPE] Select **F1** $a_n = 10 + (n-1) \times 3$ (use the button F1 for n)
[F5:SET] Start: 1, End : 100

In order to get the sums as well, use SETUP (shift-menu)

Σ DISPLAY: On

Press **[EXE]** to get the lists for u_n and S_n. You can find all the answers

(a) 157 (b) 4175 (c) $u_{65} = 202$ (d) 64 (e) S_{64}=6688

18. PERCENTAGE GROWTH: Use **[RECUR]**

The populations in cities A and B today are 100,000 and 150,000 respectively.
They increase by 3,1% and 2,3% per year respectively
Find

(a) The population of the two cities after 12 years
(b) After how many full years the population of city A exceeds 200,000
(c) After how many full years the population of city A exceeds the one of B.

Answer

We use the formulas

$$a_n = 100000 \times (1.031)^n$$

$$b_n = 150000 \times (1.023)^n$$

Remember to remove the sums and start form 0 now

SETUP (shift-menu) **Σ DISPLAY: On**
[F5:SET] Start: 0, End : 100

(a) 144,246 and 197,060 (b) 23 years (c) 53 years