# TI-Nspire ${ }^{\text {TM }}$ CAS Assisted Solutions <br> VCE Specialist Mathematics Written Sample Examination 2 Section A 

## Explanatory notes:

Note that the VCAA only supplies multiple-choice answers to sample papers. Every effort has been made to ensure that these solutions are correct.

The author of these solutions has no affiliation with the VCAA.

## SECTION A - Multiple-choice questions

Question 1:
Answer: B

| Working | TI-Nspire CAS screenshot(s) |
| :---: | :---: |
| So $a=3$ and $b+13=5^{2} \Rightarrow b=12$. |  |
|  | completeSquare $\left(x^{2}-6 \cdot x+y^{2}+4 \cdot y=b, x, y\right) 1$ |
|  | I |

Question 2:
Answer: B


## Question 3:

Answer: D

| Working $f(x)=\frac{(x-1)(x-3)}{(x+2)(x-3)}$ <br> so $f(x)=1-\frac{3}{x+2}, x \neq 3$ | TI-Nspire CAS screenshot(s) |
| :---: | :---: |
|  | 4 2.1 2.2 3.1 |
|  | $f(x):=\frac{x^{2}-4 \cdot x+3}{x^{2}-x-6}$ <br> Done |
|  | $\begin{aligned} \text { factor } & \left.\left\{x^{2}-4 \cdot x+3, x^{2}-x-6\right\}\right) \\ & \{(x-3) \cdot(x-1),(x-3) \cdot(x+2)\} \end{aligned}$ |
|  | $\Delta \operatorname{propFrac}(f(x)) \quad 1-\frac{3}{x+2}$ |
|  |  |
|  |  |
|  |  |


| Working <br> Use of the expand command suggests that the answer is $\mathbf{D}$. | TI-Nspire CAS screenshot(s) |
| :---: | :---: |
|  |  |
|  | expand $\left(\frac{7 \cdot x-5}{(x-4)^{2} \cdot\left(x^{2}+9\right)}\right)$ $\frac{9 \cdot x}{625 \cdot\left(x^{2}+9\right)}-\frac{539}{625 \cdot\left(x^{2}+9\right)}-\frac{9}{625 \cdot(x-4)}+\cdots$ |
|  | I |
|  |  |
|  | (4) $\begin{aligned} & \text { expand }\left(\frac{7 \cdot x-5}{(x-4)^{2} \cdot\left(x^{2}+9\right)}\right) \\ & -\frac{539}{625 \cdot\left(x^{2}+9\right)}-\frac{9}{625 \cdot(x-4)}+\frac{23}{25 \cdot(x-4)^{2}}\end{aligned}$ |
|  | O |

Working
You could use TI-Nspire CAS to
check some (or all) of the
alternatives.
$x^{2}+y^{2}=4$ from alternative $\mathbf{D}$.

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## Question 6:

Answer: B

## Working

From the conjugate root theorem, $z=-3 i$ is also a root.
So $B$.

## TI-Nspire CAS screenshot(s)

TI-Nspire CAS functionality does not offer any assistance here.

## Question 7:

Answer: B



## Question 9:

Answer: E

## Working

$y_{1}=2+0.1 \times 2=2.20$
The Notes application featuring
Euler's method can be used in an exam.

## TI-Nspire CAS screenshot(s)

$$
\begin{aligned}
& \mathrm{f}(\mathrm{x}):=\frac{x+2}{x^{2}+2 \cdot x+1} \text {, Done } \\
& \mathrm{x} \mathbf{0}=\mathbf{=} \text { - } 0 \\
& \mathrm{xf}:=0.1 \times 0.1 \\
& \mathbf{y} \mathbf{0}=2 \text { - } 2 \\
& \text { step: }=0.1 \times 0.1 \\
& \left.\operatorname{euler}(\mathbf{f}(x), x, y,\{\mathbf{x} \mathbf{0}, \mathbf{x f}\}, \mathbf{y} \mathbf{0}, \mathbf{s t e p}) \cdot\left[\begin{array}{ll}
0 & 0.1 \\
2 & 2.2
\end{array}\right] \right\rvert\,
\end{aligned}
$$

| Working$\begin{aligned} V & =\pi \int_{0}^{\frac{\pi}{2}} x^{2} d y \\ & =\frac{\pi}{8} \int_{0}^{\frac{\pi}{2}}(1-\cos (2 y)) d y \end{aligned}$ | TI-Nspire CAS screenshot(s) |
| :---: | :---: |
|  |  |
|  | solve $\left(y=\sin ^{-1}(2 \cdot x), x\right) \quad x=\frac{\sin (y)}{2}$ and $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$ |
|  | $x^{2}=\left(\frac{\sin (y)}{2}\right)^{2} \quad x^{2}=\frac{(\sin (y))^{2}}{4}$ |
|  | (1) tCollect $\left(x^{2}=\frac{(\sin (y))^{2}}{4}\right) \quad x^{2}=\frac{1}{8}-\frac{\cos (2 \cdot y)}{8}$, |
|  | $y=\sin ^{-1}(2 \cdot x) \left\lvert\, x=\left\{0, \frac{1}{2}\right\} \quad y=\left\{0, \frac{\pi}{2}\right\}\right.$ |

## Question 11:

Answer: C


| Working | TI-Nspire CAS screenshot(s) |
| :---: | :---: |
| $\underset{\sim}{\mathrm{a}} \cdot \underset{\sim}{\mathrm{~b}}=\frac{\mathrm{c}}{3}$ |  |
| The Notes application can be used to calculate the scalar resolute. | Scalar resolute of $a$ in the direction of $b$ $\left\{\begin{array}{l} \mathbf{a}:=\left[\begin{array}{lll} 3 & 0 & -1 \end{array}\right] \cdot\left[\begin{array}{lll} 3 & 0 & -1 \end{array}\right] \\ \mathbf{b}:=\left[\begin{array}{lll} 2 & -1 & -2 \end{array}\right] \cdot\left[\begin{array}{lll} 2 & -1 & -2 \end{array}\right] \\ \text { scalar_resolute }: \left.=\operatorname{dotP}(\mathbf{a}, \text { unitV}(\mathbf{b})) \cdot \frac{8}{3} \right\rvert\, \end{array}\right.$ |

## Question 13:

Answer: B


Answer: C

| Working | TI-Nspire CAS screenshot(s) |
| :--- | :--- |
| The diagonals of a rhombus are | TI-Nspire CAS functionality does not offer |
| perpendicular so: |  |
| $(\underset{\sim}{a}+\underset{\sim}{b}) \cdot(\underset{\sim}{a}-\underset{\sim}{b})=0$ |  |$\quad$| ans assistance here. |
| :--- |


| Working$F=12\left(3 x-\frac{3 x^{2}}{2}\right)$ | TI-Nspire CAS screenshot(s) |
| :---: | :---: |
|  |  |
|  | $v:=\sqrt{3 \cdot x^{2}-x^{3}+16} \quad \sqrt{-x^{3}+3 \cdot x^{2}+16}$ |
|  | $\triangle \frac{d}{d x}\left(\frac{v^{2}}{2}\right) \quad \frac{-3 \cdot x \cdot(x-2)}{2}$ |
|  | expand $\left(\frac{-3 \cdot x \cdot(x-2)}{2}\right) \quad 3 \cdot x-\frac{3 \cdot x^{2}}{2}$ |
|  |  |

Question 16:
Answer: D
Working
Solving the differential equation and
then obtaining $v$ in terms of $t$ gives
D $v=e^{\sqrt{2 t+\left(\log _{c} 5\right)^{2}}}$.

## TI-Nspire CAS screenshot(s)

$14.115 .116 .1>{ }^{12016} \mathrm{VCE} \ldots \mathrm{E} 2$
deSolve $\left(v^{\prime}=\frac{v}{\ln (v)}\right.$ and $\left.v(0)=5, t, v\right)$

$$
\frac{(\ln (\nu))^{2}}{2}-\frac{(\ln (5))^{2}}{2}=t
$$

solve $\left.\left(\frac{(\ln (\nu))^{2}}{2}-\frac{(\ln (5))^{2}}{2}=t, v\right) \right\rvert\, v>0$ and $t>0$
$\nu=\mathrm{e}^{\sqrt{2 \cdot t+(\ln (5))^{2}}}$ and $t>0$ or $v=\mathrm{e}^{-\sqrt{2 \cdot t+(\ln ( }}$


## Question 18:

Answer: E
Working

| $\mathrm{E}(Z)$ | $=\mathrm{E}(X)-3 \mathrm{E}(Y)$ |
| ---: | :--- |
|  | $=10-9$ |
|  | $=1$ |


| $\operatorname{var}(Z)$ | $=(1)^{2} \operatorname{var}(X)+(-3)^{2} \operatorname{var}(Y)$ |
| ---: | :--- |
|  | $=8^{2}+9 \times 2^{2}$ |
|  | $=100$ |


| $\mathrm{sd}(Z)$ | $=10$ |
| ---: | :--- |

The Notes application can be used to
perform expectation calculations.

TI-Nspire CAS screenshot(s)

### 16.117 .118 .1 > 2016 VCE ... E2 $\nabla$ <br> RAD \%

Expectation algebra

$$
\begin{aligned}
& \mu \mathrm{x}:=10 \cdot 10 \\
& \boldsymbol{\sigma x}=8 \cdot 8 \\
& \mu \mathrm{y}:=3 \text { - } 3 \\
& \text { бy }:=2 \cdot 2 \\
& \text { b: }=-3 \text { - }-3 \\
& \boldsymbol{\mu z}=\mathbf{=} \cdot \boldsymbol{\mu} \mathbf{x}+\mathbf{b} \cdot \boldsymbol{\mu} \mathbf{y} \cdot 1 \\
& \sigma z=\sqrt{a^{2} \cdot \sigma x^{2}+\mathbf{b}^{2} \cdot \sigma y^{2}} \cdot 10 \mid
\end{aligned}
$$

## Working

Let $\bar{X}$ be the class mean.
$\mathrm{E}(\bar{X})=30$ and $\operatorname{var}(\bar{X})=\frac{7^{2}}{20}$
$\operatorname{Pr}(\bar{X}>32)=0.1007$
The Notes application can be used to perform normal distribution calculations.

## TI-Nspire CAS screenshot(s)

### 17.1 18.1 19.1 > *2016 VCE ... E2 $\nabla$

Normal distribution calculations
$\boldsymbol{\mu}=30$ - 30
sigma: $=7 \cdot 7$
$\mathbf{n}:=20 \cdot 20$
$\operatorname{normCdf}\left(32, \infty, \boldsymbol{\mu}, \frac{\text { sigma }}{\sqrt{\mathbf{n}}}\right) \cdot 0.100668$

## Question 20:

Answer: C

| Working <br> A type I error is made where $\mathrm{H}_{0}$ is <br> rejected when $\mathrm{H}_{0}$ is true. | TI-Nspire CAS screenshot(s) |
| :--- | :--- |
| TI-Nspire CAS functionality does not offer |  |
| any assistance here. |  |

