Neap

Trial Examination 2023

Suggested Solutions

QCE Specialist Mathematics Units 3&4

Paper 2 – Technology-active

SECTION 1 – MULTIPLE CHOICE QUESTIONS

	A	B	C	D
1.	○	○	●	○
2.	○	●	○	○
3.	●	○	○	○
4.	○	○	●	○
5.	○	○	○	●
6.	●	○	○	○
7.	○	○	●	○
8.	○	○	●	○
9.	○	●	○	○
10.	○	○	○	●

QUESTION 1 C

C is correct.

$$\begin{aligned}\varphi &= \tan^{-1}\frac{c}{\sqrt{a^2+b^2}}\\ &= \tan^{-1}\frac{7}{\sqrt{2^2+(-3)^2}}\\ &= \tan^{-1}\frac{7}{\sqrt{13}}\\ &= 1.095^c\end{aligned}$$

A is incorrect. This option may be reached by using the modulus of the vector, $\sqrt{62}$, rather than $\sqrt{13}$.

B is incorrect. This option may be reached by calculating the azimuth, θ.

D is incorrect. This option may be reached by finding the obtuse angle variation for the altitude.

QUESTION 2 B

B is correct.

$$\int\frac{7x+3}{(x+3)(2x-3)}dx \equiv \frac{A}{x+3}+\frac{B}{2x-3}$$

$$7x+3 \equiv A(2x-3)+B(x+3)$$

When $x = 1.5$:

$$\begin{aligned}7x+3 &= B(x+3)\\ 13.5 &= 4.5\times B\\ B &= 3\end{aligned}$$

When $x = -3$:

$$\begin{aligned}7x+3 &= A(2x-3)\\ -18 &= -9A\\ A &= 2\end{aligned}$$

Therefore, $\int\frac{7x+3}{(x+3)(2x-3)}dx = \int\frac{2}{x+3}+\frac{3}{2x-3}dx$

A is incorrect. This option may be reached by substituting $A = -3$ and $B = 1.5$ into the initial equation.

C is incorrect. This option may be reached by using $x = -3$ to find B.

D is incorrect. This option may be reached by making an error when calculating A using –3.

QUESTION 3 A

A is correct. When $x = 1$:

$$y + (4 \times 1)y - 1^2 = 7$$
$$y = \frac{8}{5}$$
$$\frac{d}{dx}\left(y + 4xy - x^2\right) = \frac{d}{dx}(7)$$
$$\frac{dy}{dx} + 4y + 4x - 2x = 0$$
$$\frac{dy}{dx}(1 + 4x) = 2x - 4y$$
$$\frac{dy}{dx} = \frac{2x - 4y}{1 + 4x}$$

Substituting $x = 1$ and $y = \frac{8}{5}$ gives:

$$\frac{dy}{dx} = \frac{2(1) - 4\left(\frac{8}{5}\right)}{1 + 4(1)}$$
$$= -\frac{22}{25}$$
$$= -0.88$$

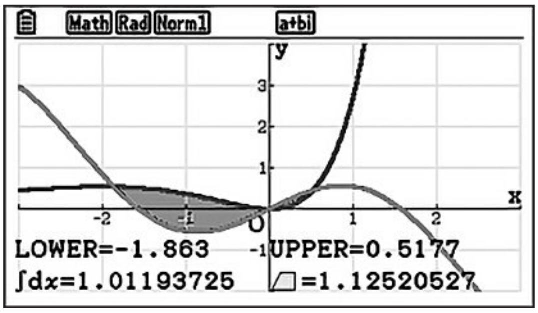
B is incorrect. This option may be reached by finding and substituting $y = \frac{6}{5}$.

C is incorrect. This option may be reached by substituting $x = 1$ and $y = 1$.

D is incorrect. This option may be reached by leaving out the term $4x\frac{dy}{dx}$ in the product rule.

QUESTION 4 C

C is correct. Using a graphics calculator gives:



A is incorrect. This option may be reached by calculating the area of the shaded region above the x-axis.

B is incorrect. This option may be reached by calculating the area of the shaded region below the x-axis.

D is incorrect. This option may be reached by not treating both parts of the shaded region as positive.

QUESTION 5 D

D is correct.

$$\frac{dy}{dx} = 6x^2 y$$

$$\int \frac{1}{y}dy = \int 6x^2 dx$$

$$\ln y = 2x^3 + c$$

$$y = e^{2x^3 + c}$$

$$= Ae^{2x^3}$$

Thus, any expression in the form $y = e^{2x^3 + c}$ or $y = Ae^{2x^3}$, with any given A or c, is a possible solution to this equation.

A is incorrect. This option may be reached by differentiating the x term.

B is incorrect. This option may be reached by incorrectly differentiating the power and using the constant term.

C is incorrect. This option may be reached by incorrectly applying the constant after transforming from a logarithm to an exponential.

QUESTION 6 A

A is correct. The system is inconsistent when the determinant is zero. Therefore:

$$\det\begin{bmatrix} 2 & -1 & -1 \\ 1 & 4 & 1 \\ k & 0 & 1 \end{bmatrix} = 0$$

When $k = -3$, $\det\begin{bmatrix} 2 & -1 & -1 \\ 1 & 4 & 1 \\ -3 & 0 & 1 \end{bmatrix} = 0$.

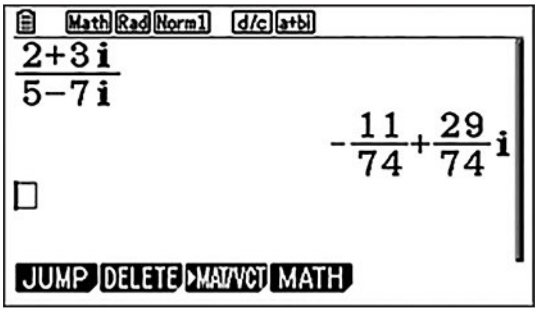
B is incorrect. This option may be reached by evaluating k as 0.

C is incorrect. This option may be reached using $\det\begin{bmatrix} 2 & -1 & -1 \\ 1 & 4 & 1 \\ 0 & k & 1 \end{bmatrix} = 0$.

D is incorrect. This option may be reached using $\det\begin{bmatrix} 2 & -1 & -1 \\ 1 & 4 & 1 \\ k & 1 & 0 \end{bmatrix} = 0$.

QUESTION 7 C

C is correct. Using a graphics calculator gives:



A is incorrect. This option may be reached by inputting $5 + 7i$ as the denominator.

B is incorrect. This option may be reached by incorrectly using a complex conjugate.

D is incorrect. This option may be reached by making a calculation error using the fraction functionality in the calculator.

QUESTION 8 C

C is correct. Using $\frac{d}{dx}\left(\tan^{-1}\left(\frac{x}{a}\right)\right) = \frac{a}{a^2 + x^2}$ gives:

$$\begin{aligned}\int \frac{2}{9+x^2}dx &= \frac{2}{3}\int \frac{3}{9+x^2}dx \\ &= \frac{2}{3}\tan^{-1}\left(\frac{x}{3}\right) + c\end{aligned}$$

A is incorrect. This option may be reached by using an incorrect rule from the fractional format.

B is incorrect. This option may be reached by making an error in the calculation or not considering the constant multiple.

D is incorrect. This option may be reached by confusing the logarithmic and trigonometric inverse laws.

QUESTION 9 B

B is correct. Finding the quantile gives:

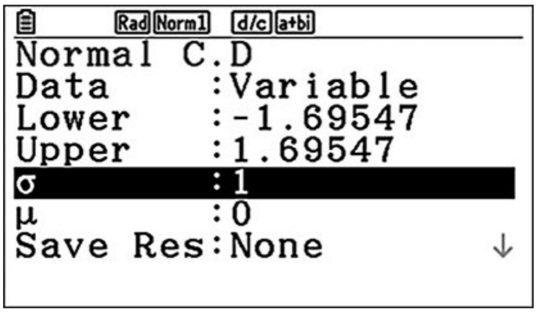
$$\text{margin of error} = z_x \times \frac{s}{\sqrt{n}}$$

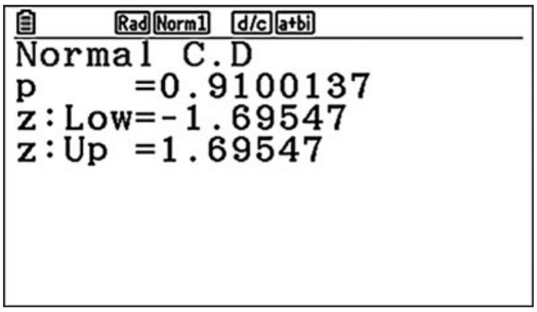
$$\frac{32.2183 - 31.5816}{2} = z_x \times \frac{2.3}{\sqrt{150}}$$

$$0.31835 = z_x \times \frac{2.3}{\sqrt{150}}$$

$$z_x = 1.6954 \ldots$$

Using a graphics calculator gives:





$$\begin{aligned} x &= 0.91 \\ &= 91\% \end{aligned}$$

A is incorrect. This option may be reached by incorrectly rounding the solution.

C is incorrect. This option may be reached through translation errors.

D is incorrect. This option may be reached by using a left tail, rather than a centre approach.

QUESTION 10 D

D is correct. As $i = \text{cis}(90°)$, using De Moivre's theorem shows that multiplying by i will increase the angle by 90°. Thus, it will cause z to be rotated counter-clockwise by 90°.

A and **B** are incorrect. Multiplying by i adjusts the argument only.

C is incorrect. Multiplying by i adds 90° to the argument, which moves it counter-clockwise.

SECTION 2

QUESTION 11 (5 marks)

a) The standard periodic function for simple harmonic motion is $y = A\sin(\omega t + a)$.

The graph has an amplitude of 2 m; therefore, $A = 2$ m.

The graph shows three complete cycles over four seconds. Therefore:

$$T = \frac{2\pi}{\omega}$$
$$\frac{4}{3} = \frac{2\pi}{\omega}$$
$$\omega = \frac{3\pi}{2}$$

[2 marks]
1 mark for determining the value of A.
1 mark for determining the value of ω. Note: Accept equivalent values; for example, 1.5π.

b)
$$v^2 = \omega^2\left(A^2 - x^2\right)$$
$$= \left(\frac{3\pi}{2}\right)^2\left(2^2 - 1^2\right)$$
$$v = \frac{3\pi\sqrt{3}}{2}$$
$$= 8.1621 \text{ m s}^{-1}$$

[1 mark]
1 mark for determining the value of v.
*Note: Consequential on answer to **Question 11a)**.*

c)
$$a = -A\omega^2\sin\left(\omega t + a\right)$$
$$= -2\times\left(\frac{3\pi}{2}\right)^2\sin\left(\frac{3\pi}{2}t\right)$$
$$= -\frac{9\pi^2}{2}\sin\left(\frac{3\pi}{2}t\right)$$

Given that maximum acceleration occurs when $\sin\left(\frac{3\pi}{2}t\right) = -1$:

$$\text{maximum acceleration} = -\frac{9\pi^2}{2}\times -1$$
$$= \frac{9\pi^2}{2}$$
$$= 44.41 \text{ m s}^{-2}$$

[2 marks]
1 mark for determining the model for acceleration and recognising the value that maximises the model. Note: The model for acceleration may be implied by subsequent working.
1 mark for providing the correct solution.

QUESTION 12 (7 marks)

a) $\bar{x} = \dfrac{84.6 + 89.2}{2}$

$= 86.9$

[1 mark]

1 mark for determining the sample mean.

b) $z_{95}\dfrac{\sigma}{\sqrt{n}} = \dfrac{89.2 - 84.6}{2}$

$1.96 \times \dfrac{\sigma}{\sqrt{60}} = 2.3$

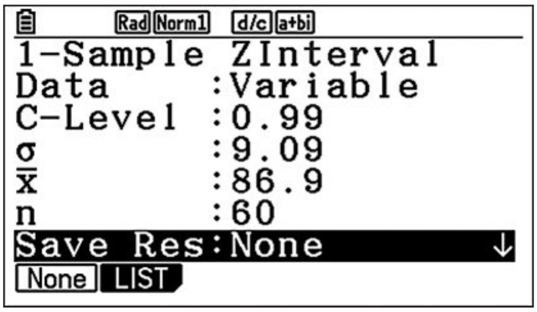
$\sigma = 9.09$

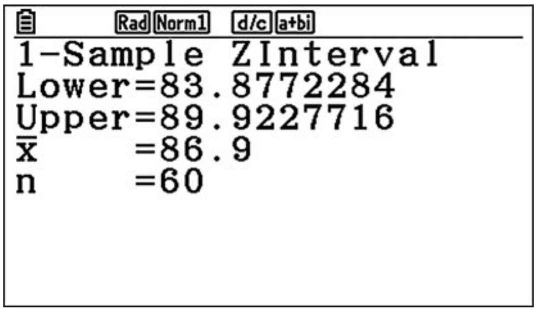
[2 marks]

1 mark for using an appropriate formula involving the margin of error.

1 mark for providing the correct solution.

c) Using a graphics calculator to find the 99% confidence interval, where $\bar{x} = 86.9$ and $\sigma = 9.09$ gives:





$CI_{99} = (83.88, 89.92)$

[1 mark]

1 mark for stating the approximate confidence interval. Note: Accept any correct rounding.

d) For the 95% confidence interval of the second sample:

$$\begin{aligned}\text{margin of error} &= 0.7 \times 2.3 \\ &= 1.61\end{aligned}$$

$n = 60 + x$

$\sigma = 9.09$

Therefore:

$$\text{margin of error}_{95} = z_{95}\frac{\sigma}{\sqrt{n}}$$

$$1.61 = 1.96\frac{9.09}{\sqrt{60+x}}$$

$$\frac{9.09}{\sqrt{60+x}} = \frac{1.61}{1.96}$$

$$9.09 = 0.8214 \times \sqrt{60+x}$$

$$60 + x = \left(\frac{9.09}{0.8214}\right)^2$$

$$\begin{aligned}x &= 62.466\ \ldots \\ &= 62\end{aligned}$$

[3 marks]

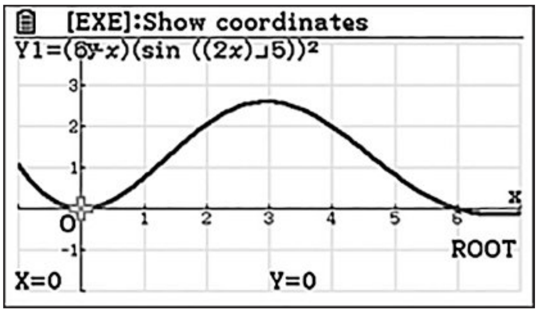
1 mark for substituting into the margin of error formula.

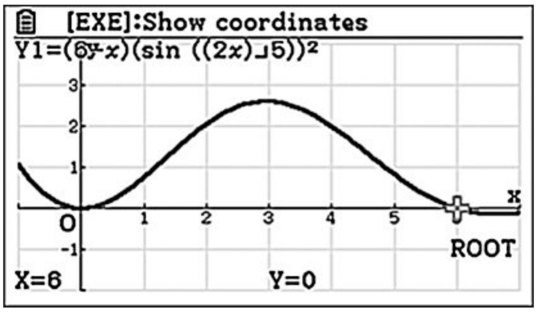
1 mark for calculating the unrounded value of x. Note: This mark may be implied by subsequent working.

1 mark for interpreting that x must be a whole number and appropriately rounding the value of x.

QUESTION 13 (5 marks)

a) Using a graphics calculator shows x-intercepts at $x = 0$ and $x = 6$, and width of a strip, $w = 1$.





Therefore, letting w be 1 and using the table function in the graphics calculator gives:

X	Y1
0	0
1	0.7582
2	2.0583
3	2.606

X	Y1
3	2.606
4	1.9982
5	0.8268
6	0

Using Simpson's rule gives:

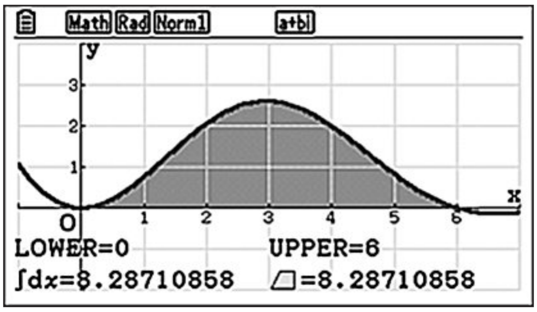
$$A = \frac{w}{3}\left(h_0 + h_6 + 4\left(h_1 + h_3 + h_5\right) + 2\left(h_2 + h_4\right)\right)$$

$$= \frac{1}{3}\left(0 + 0 + 4\left(0.7582 + 2.606 + 0.8268\right) + 2\left(2.0583 + 1.9982\right)\right)$$

$$= 8.2923\ldots \text{ units}^2$$

[4 marks]
1 mark for finding the start and end points of the shaded area.
1 mark for providing the correct values for all coordinates within the domain.
1 mark for substituting into the Simpson's rule formula.
1 mark for providing the correct solution.

b) Using a graphics calculator to find the exact area gives:



$A = 8.2871\ldots$ units^2

The area found using Simpson's rule is out by 0.052… units^2, or 0.063%; therefore, the approximation is very accurate.

[1 mark]

1 mark for providing the exact area under the curve and drawing a conclusion regarding reasonableness.

Note: Consequential on answer to ***Question 13a)****.*

QUESTION 14 (6 marks)

a)

$$D_1 = \begin{bmatrix} 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

[1 mark]

1 mark for stating D_1.

b)

$$D_1 \times \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 2 \\ 3 \\ 3 \\ 1 \\ 1 \end{bmatrix}$$

First place (tied): team B and team C

Second place: team A

Third place (tied): team D and team E

[1 mark]

1 mark for listing the ranking, including any ties that occurred.

Note: Consequential on answer to ***Question 14a)****.*

c)

$$\left(D_1+\frac{1}{2}D_2\right)\times\begin{bmatrix}1\\1\\1\\1\\1\end{bmatrix}=\left(D_1+\frac{1}{2}(D_1)^2\right)\times\begin{bmatrix}1\\1\\1\\1\\1\end{bmatrix}$$

$$=\left(\begin{bmatrix}0&0&1&0&1\\1&0&0&1&1\\0&1&0&1&1\\1&0&0&0&0\\0&0&0&1&0\end{bmatrix}+\frac{1}{2}\begin{bmatrix}0&0&1&0&1\\1&0&0&1&1\\0&1&0&1&1\\1&0&0&0&0\\0&0&0&1&0\end{bmatrix}^2\right)\times\begin{bmatrix}1\\1\\1\\1\\1\end{bmatrix}$$

$$=\begin{bmatrix}4\\5\\5.5\\2\\1.5\end{bmatrix}$$

Therefore, the ranking from first to last is C, B, A, D, E.

[3 marks]
1 mark for setting up the dominance relationship, including the column matrix of ones.
1 mark for stating the resultant column matrix.
1 mark for providing the correct ranking for all teams.
*Note: Consequential on answer to **Question 14a)**.*

d) *Any one of:*

- The tie for first place has been split in favour of team C, as team C beat team B in the competition.
- The tie for last place has been split with team E in last place as team D won against team A, who were a higher-ranking team than team E.

[1 mark]
1 mark for drawing a conclusion about either tie and stating how the new results relate to the individual outcomes.
*Note: Consequential on answer to **Questions 14b)** and **14c)**.*

QUESTION 15 (5 marks)

a) Let R be the resistive force and F_R the resultant force.

$F_R = (F\cos(18) - R)\boldsymbol{i} + \left(F\sin(18) + N_R - W\right)\boldsymbol{j}$

Considering the horizontal component:

$$F\cos(18) - R = ma$$
$$110 \times \cos(18) - R = 30 \times 2.2$$
$$R = 110 \times \cos(18) - 30 \times 2.2$$
$$= 38.6162\ldots \text{ N}$$

[3 marks]

1 mark for resolving the forces into horizontal and vertical components.

1 mark for substituting into the $f = ma$ formula.

1 mark for determining the magnitude of the resistive force .

b) Using the vertical component found in Question 15a), or otherwise, gives:

$$100 \times \sin(18) + N_R - W = 0$$
$$N_R = 9.8 \times 30 - 110 \times \sin(18)$$
$$= 260.0081\ldots \text{ N}$$

[2 marks]

1 mark for equating the vertical component to 0.

1 mark for calculating the magnitude of the normal reactive force.

QUESTION 16 (6 marks)

a) **Method 1:**

Let $a=\left(1+x^2\right)^{\frac{1}{2}}$ and $b=x$.

Thus:

$$a'=\frac{1}{2}\left(1+x^2\right)^{-\frac{1}{2}}\times 2x$$

$$=x\left(1+x^2\right)^{-\frac{1}{2}}$$

$$b'=1$$

$$\frac{dv}{dx}=\frac{a'b-b'a}{b^2}$$

$$=\frac{x\times x\left(1+x^2\right)^{-\frac{1}{2}}-1\times\left(1+x^2\right)^{\frac{1}{2}}}{x^2}$$

$$=\frac{\left(1+x^2\right)^{-\frac{1}{2}}\left(x^2-\left(1+x^2\right)\right)}{x^2}$$

$$=\frac{-1}{x^2\sqrt{1+x^2}}$$

$$a=v\times\frac{dv}{dx}$$

$$=\frac{\sqrt{1+x^2}}{x}\times\frac{-1}{x^2\sqrt{1+x^2}}$$

$$=-\frac{1}{x^3}$$

At $x=4.5$ m:

$$a=-\frac{1}{4.5^3}$$

$$=-\frac{8}{729}\text{ m s}^{-2}\text{ or }-0.0109\ldots\text{ m s}^{-2}$$

[3 marks]

1 mark for determining $\frac{dv}{dx}$.

1 mark for using $a=v\times\frac{dv}{dx}$ to determine a simplified value for a.

1 mark for determining the acceleration at $x=4.5$ m.

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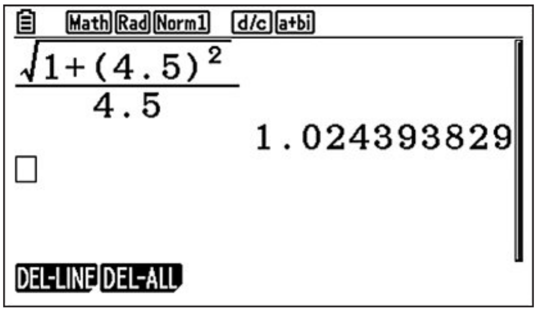
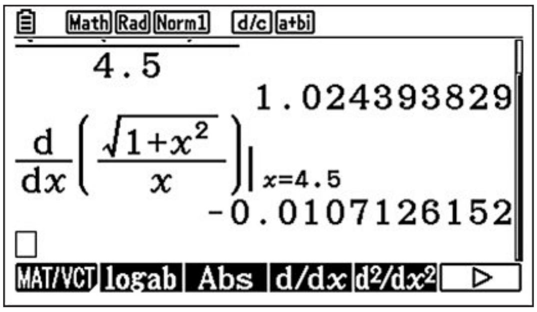
Method 2:

Using a graphics calculator to solve v when $x = 4.5$ m gives:



$v = 1.02439$

Using a graphics calculator to solve $\frac{dv}{dx}$ when $x = 4.5$ m gives:



$\frac{dv}{dx} = -0.010713$

Therefore:

$$
\begin{aligned}
a &= v \times \frac{dv}{dx} \\
&= 1.02239 \times -0.010713 \\
&= -0.0109 \text{ m s}^{-2}
\end{aligned}
$$

[3 marks]
1 mark for calculating the value of v.
1 mark for calculating the value of $\frac{dv}{dx}$.
1 mark for determining the acceleration at $x = 4.5$ m.

b) $v = \dfrac{\sqrt{1+x^2}}{x}$

$\dfrac{dx}{dt} = \dfrac{\sqrt{1+x^2}}{x}$

Thus:

$\int \dfrac{x}{\sqrt{1+x^2}} dx = \int dt$

Let $u = 1 + x^2$, $\dfrac{du}{dx} = 2x$ and $dx = \dfrac{du}{2x}$.

$\int \dfrac{x}{\sqrt{u}} \dfrac{du}{2x} = t + c$

$\dfrac{1}{2} \int u^{-\frac{1}{2}} du = t + c$

$\sqrt{u} = t + c$

$\sqrt{1+x^2} = t + c$

At $x = 2$, $t = 0$ and $c = \sqrt{5}$:

$\sqrt{1+x^2} = t + \sqrt{5}$

At $t = 3$:

$\sqrt{1+x^2} = 3 + \sqrt{5}$

$x = 5.1397$ m

[3 marks]
1 mark for using differential equations to set up the integral.
1 mark for substituting into the integral and finding a relationship between x and t.
1 mark for providing the correct solution.

QUESTION 17 (5 marks)

Using CI_{90} = (397 g, 436 g) gives:

$$\bar{x} = \frac{397+436}{2}$$
$$= 416.5 \text{ g}$$

$z_{90} = 1.645$

Therefore:

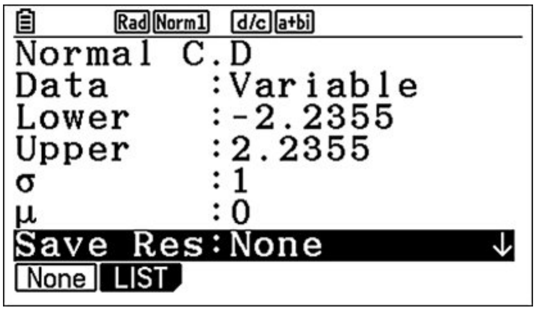
$$\text{margin of error} = z_{90} \times \frac{s}{\sqrt{n}}$$
$$416.5 - 397 = 1.645 \times \frac{s}{\sqrt{n}}$$
$$\frac{s}{\sqrt{n}} = \frac{19.5}{1.645}$$

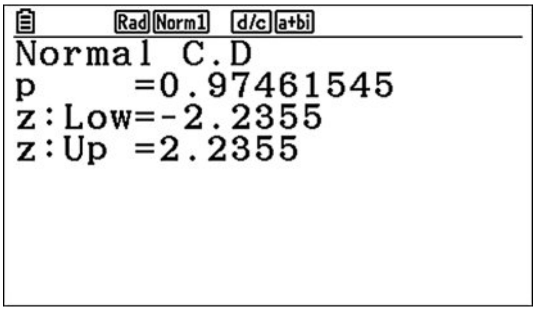
Let CI_x be the confidence interval that includes 390 g, where x is the confidence level.

Given that $\bar{x} = 416.5$ g and $\frac{s}{\sqrt{n}} = \frac{19.5}{1.645}$:

$$\text{margin of error} = z_x \times \frac{s}{\sqrt{n}}$$
$$416.5 - 390 = z_x \times \frac{19.5}{1.645}$$
$$26.5 = z_x \times 11.8541$$
$$z_x = 2.2355$$

Using a graphics calculator to find the confidence level for $z_x = 2.2355$ gives:





Thus, $x = 0.9746$ or 97.46%.

A 97% confidence level will not include 390 g; therefore, 98% is the lowest confidence level that will include 390 g when rounded to a whole number.

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[5 marks]

1 mark for determining the value for $\frac{s}{\sqrt{n}}$.

1 mark for applying the $\frac{s}{\sqrt{n}}$ value to a confidence interval that will contain 390 g.

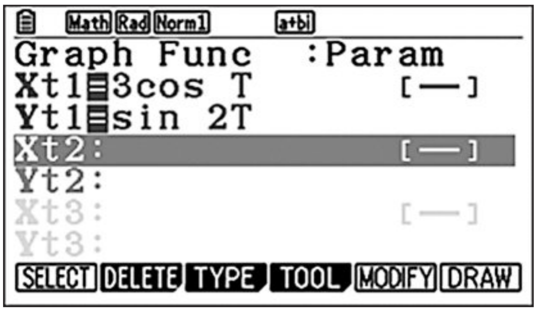
1 mark for determining the value of z_x.

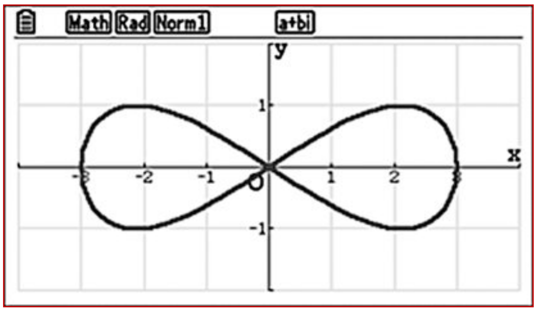
1 mark for determining the value of x.

1 mark for providing the correct solution by rounding appropriately.

QUESTION 18 (5 marks)

Letting $a = 3$ to find the initial shape of the function gives:





When $r(\theta) = (a\cos(\theta))\boldsymbol{i} + (\sin(2\theta))\boldsymbol{j}$:

$x = a\cos(\theta)$

$$\begin{aligned} y &= \sin(2\theta) \\ &= 2\sin(\theta)\cos(\theta) \end{aligned}$$

$$\begin{aligned} x^2 &= a^2\cos^2(\theta) \\ &= a^2\left(1-\sin^2(\theta)\right) \end{aligned}$$

Therefore, $\cos^2(\theta) = \frac{x^2}{a^2}$ and $\sin^2(\theta) = 1 - \frac{x^2}{a^2}$.

Substituting into $y^2 = 4\sin^2(\theta)\cos^2(\theta)$ gives:

$$y^2 = \frac{4x^2}{a^2}\left(1 - \frac{x^2}{a^2}\right)$$

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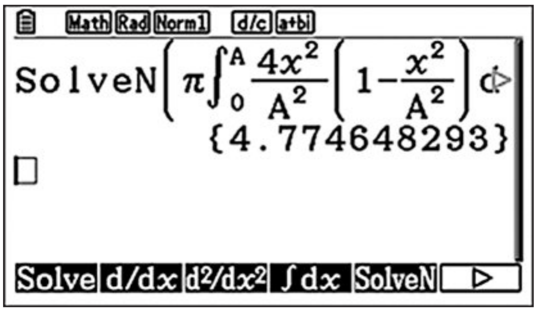
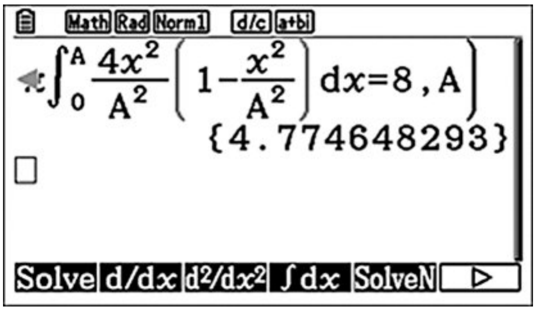
Finding the expression for the volume:

$$V = \int_0^a \pi y^2 dx$$

$$= \pi \int_0^a \frac{4x^2}{a^2}\left(1 - \frac{x^2}{a^2}\right)dx = 8$$

Using a graphics calculator to solve for *a* gives:





[5 marks]

1 mark for using trigonometric identities to simplify the ***j*** *component of the vector.*
1 mark for using the Pythagorean identity to prepare the ***i*** *component of the vector for substitution.*
1 mark for determining the Cartesian form of the vector equation.
1 mark for using the volumes of revolution formula to find an appropriate integral.
1 mark for providing the correct value of a.

QUESTION 19 (6 marks)

Motion of the ball:

Finding the velocity of the ball gives:

$$a = -g\boldsymbol{j}$$

$$v = -gt\boldsymbol{j} + v_0$$

$$v_0 = u\cos(45)\boldsymbol{i} + u\sin(45)\boldsymbol{j}$$

$$= \frac{u}{\sqrt{2}}\boldsymbol{i} + \frac{u}{\sqrt{2}}\boldsymbol{j}$$

$$v = \frac{u}{\sqrt{2}}\boldsymbol{i} + \left(\frac{u}{\sqrt{2}} - gt\right)\boldsymbol{j}$$

(continues on next page)

(continued)

Finding the displacement of the ball gives:

$$x = \frac{ut}{\sqrt{2}}\boldsymbol{i} + \left(\frac{ut}{\sqrt{2}} - \frac{gt^2}{2}\right)\boldsymbol{j} + x_0$$

$x_0 = 1.8j$

$$x = \frac{ut}{\sqrt{2}}\boldsymbol{i} + \left(1.8 + \frac{ut}{\sqrt{2}} - \frac{gt^2}{2}\right)\boldsymbol{j}$$

As the ball passes through the point (15, 2.5), simultaneous equations can be formed.

$$\frac{ut}{\sqrt{2}} = 15 \quad (1)$$

$$1.8 + \frac{ut}{\sqrt{2}} - \frac{gt^2}{2} = 2.5 \quad (2)$$

Substituting (1) into (2) to solve for t gives:

$$1.8 + 15 - \frac{gt^2}{2} = 2.5$$

$$t = 1.708 \text{ s}$$

Substituting $t = 1.708$ into (1) gives:

$$\frac{u \times 1.708}{\sqrt{2}} = 15$$

$$u = 12.4176 \text{ m s}^{-1}$$

Motion of Barry:

Barry travels from (20, 5) to (15, 2.5) before catching the ball. Therefore, the distance travelled is:

$$d = \sqrt{(15-20)^2 + (2.5-5)^2}$$
$$= 5.59 \text{ m}$$

Finding the time taken for Barry to move halfway down the escalator gives:

$$t = \frac{d}{s}$$
$$= \frac{5.59}{0.5}$$
$$= 11.18 \text{ s}$$

Chelsea should throw the ball 11.18 – 1.708 seconds after Barry steps onto the escalator.

Therefore, Chelsea should throw the ball at a speed of 12.4176 m s^{-1} and at a time of 9.47 seconds for Barry to catch it when halfway down the escalator.

[6 marks]

1 mark for determining a function that represents the ball's velocity.
1 mark for determining a function that represents the ball's displacement.
1 mark for setting up two equations for u and t that align with the coordinate of impact.
1 mark for determining the values of u and t at the moment of impact.
1 mark for determining the time taken for Barry to move halfway down the escalator.
1 mark for providing the correct solution.