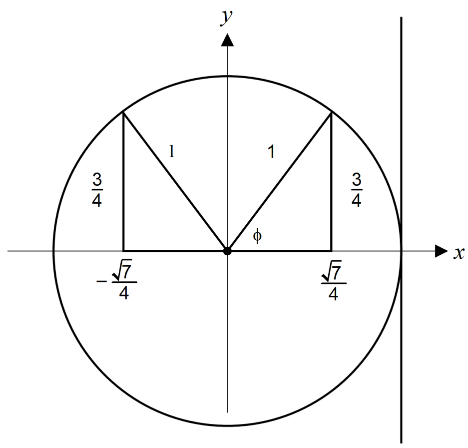
The Mathematical Association of Victoria
SOLUTIONS: Trial Exam 2014
SPECIALIST MATHEMATICS
Written Examination 2

SECTION 1: Multiple Choice

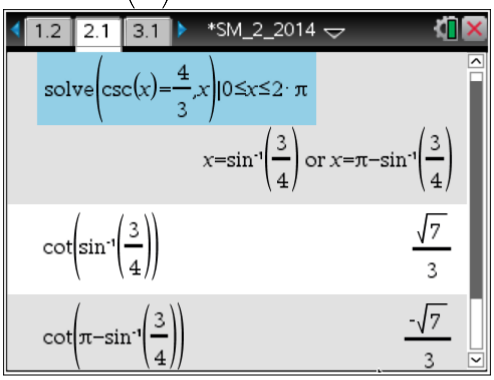
ANSWERS

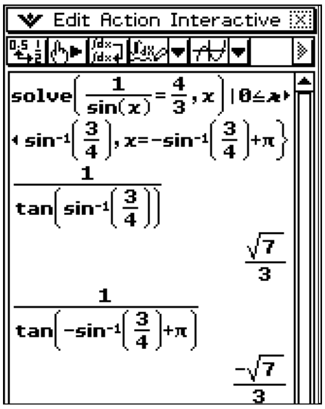
1. D	2. D	3. A	4. E	5. E	6. D
7. D	8. B	9. B	10. E	11. B	12. A
13. C	14. A	15. C	16. B	17. A	18. D
19. C	20. D	21. E	22. B		

Question 1 **Answer: D**



$$\cot(x) = \frac{\pm\frac{\sqrt{7}}{4}}{\left(\frac{3}{4}\right)} = \frac{\sqrt{7}}{3} \text{ or } -\frac{\sqrt{7}}{3}$$



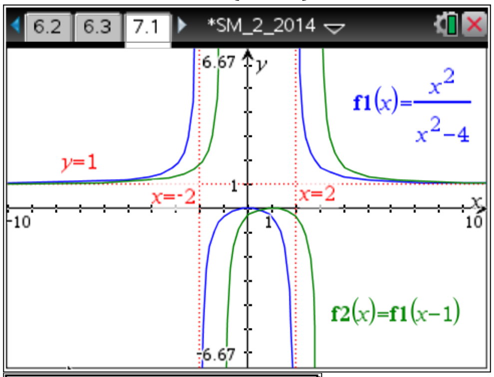


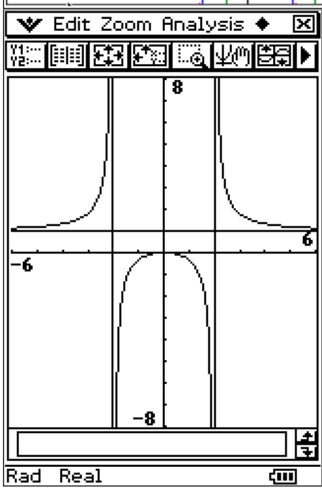
Question 2 **Answer: D**

For f, domain $R\setminus\{-2,2\}$ and range $R\setminus\{1\}$

The graph of g is a translation of 1 unit to the right, therefore:

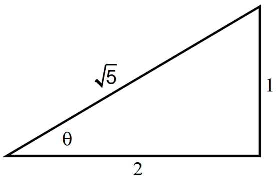
For f, domain $R\setminus\{-1,3\}$ and range $R\setminus\{1\}$





Question 3 **Answer: A**

Let $\theta = \tan^{-1}\left(\frac{1}{2}\right)$



$$\sin(2\theta) = 2\sin(\theta)\times\cos(\theta)$$

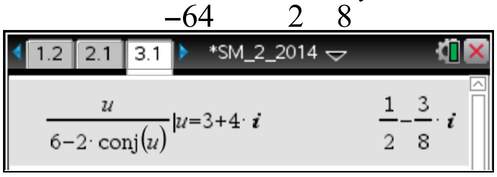
$$\sin(2\theta) = 2\times\frac{1}{\sqrt{5}}\times\frac{2}{\sqrt{5}} = \frac{4}{5}$$

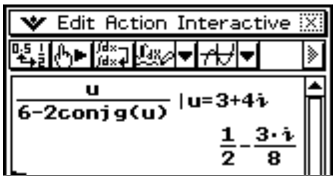
Question 4 **Answer: E**

$$\frac{u}{6-2\bar{u}} = \frac{3+4i}{6-(6-8i)}$$

$$= \frac{3+4i}{8i}\times\frac{8i}{8i}$$

$$= \frac{-32+24i}{-64} = \frac{1}{2}-\frac{3}{8}i$$





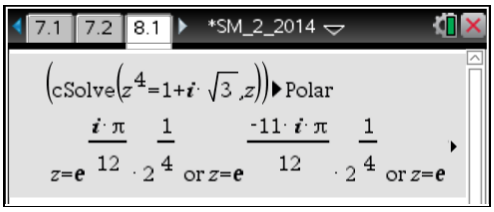
Question 5 **Answer: E**

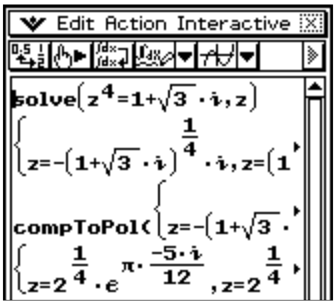
Let $z^4 = 1+i\sqrt{3} = 2\text{cis}\left(\frac{\pi}{3}\right)$

$$z = \sqrt[4]{2}\text{cis}\left(\frac{\pi}{12}+\frac{n\pi}{2}\right), n = -2, -1, 0, 1$$

$$z = \sqrt[4]{2}\text{cis}(\theta),\ \theta = -\frac{11\pi}{12}, -\frac{5\pi}{12}, \frac{\pi}{12}, \frac{7\pi}{12}$$

Alternatively, solve $z^4 = 1+i\sqrt{3}$ on CAS – being aware that $e^{i\theta} = \text{cis}(\theta)$.





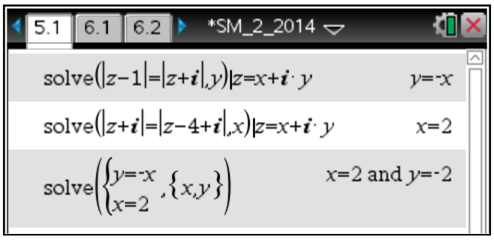
Question 6 **Answer: D**

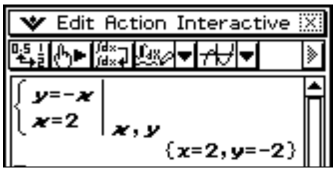
Cartesian equations:

$$|z-1| = |z+i| \Rightarrow \quad y = -x$$

$$|z+i| = |z-4+i| \Rightarrow \quad x = 2$$

Intersection is at $(2, -2)$ i.e. $2-2i$





Question 7 **Answer: D**

If p has integer coefficients, then the factors are at least

$$(z+5)(z-\sqrt{3})(z+\sqrt{3})(z-1+2i)(z-1-2i)$$

Therefore, minimum degree is 5.

Question 8 **Answer: B**

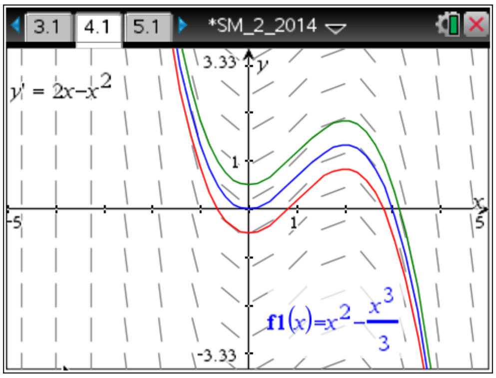
The family of functions could be of the form

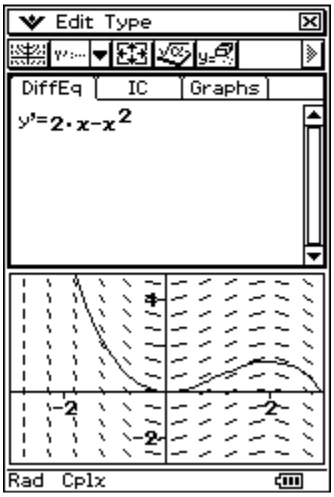
$y = ax^3+bx^2+cx+d,\ a<0.$

The DE giving rise could therefore be

$\frac{dy}{dx} = -x^2+2x$ (option B), because

$$y = \int(-x^2+2x)\,dx = -\frac{1}{3}x^3+x^2+C$$





Question 9 **Answer: B**

Let $u=\log_e\left(\sec(x)\right)=-\log_e\left(\cos(x)\right)$

$$\frac{du}{dx}=-\frac{1}{\cos(x)}\times-\sin(x)=\tan(x)$$

$$x=-\frac{\pi}{6}\Rightarrow u=-\log_e\left(\cos\left(-\frac{\pi}{6}\right)\right)=-\log_e\left(\frac{\sqrt{3}}{2}\right)$$

$$x=\frac{\pi}{3}\Rightarrow u=-\log_e\left(\frac{1}{2}\right)=\log_e(2)$$

$$\int_{-\frac{\pi}{6}}^{\frac{\pi}{3}}\left(\tan(x)\log_e\left(\sec(x)\right)\right)dx=\int_{-\log_e\left(\frac{\sqrt{3}}{2}\right)}^{\log_e(2)}u\,du$$

Question 10 **Answer: E**

Euler's method: $y_{n+1}=y_n+h\,f\left(x_n\right)$, where

$$f(x)=\log_e\left(\frac{1}{\sqrt{x}}\right)=-\frac{1}{2}\log_e(x),$$

$h=\frac{1}{10}$, $x_0=1$ and $y_0=2$.

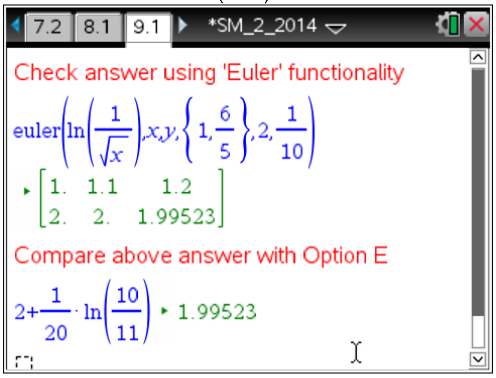
$$y_1=y_0+h\,f\left(x_0\right)$$

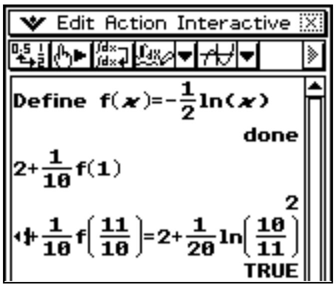
$y_1=2+\frac{1}{10}\times-\frac{1}{2}\times\log_e(1)=2$, when $x_1=1+\frac{1}{10}=\frac{11}{10}$

$$y_2=y_1+h\,f\left(x_1\right)$$

$$y_2=2+\frac{1}{10}\times-\frac{1}{2}\log_e\left(\frac{11}{10}\right)$$

$$y_2=2+\frac{1}{20}\log_e\left(\frac{10}{11}\right)$$





Question 11 **Answer: B**

$$V=\pi\int_0^2\left(y^2-1\right)dx$$

$$=\pi\int_0^2\left(\left(x^2+1\right)^2-1\right)dx$$

$$=\pi\int_0^2\left(x^4+2x^2\right)dx$$

Question 12 **Answer: A**

From the graph of *f* we can deduce

$g'(x)=0$ for $x=q$

$g''(x)=0$ (points of inflexion) somewhere between *p* and *q*, and again between *q* and *r*.

$g'(x)<0$ for $p<x<q$

$g'(x)>0$ for $q<x\le r$

Therefore Option A could be the graph of *g*, as it is the only graph shown that meets these conditions.

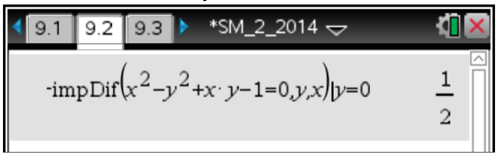
Also note that $g(p)=\int_p^p f(t)\,dt=0$ is also satisfied by Option A.

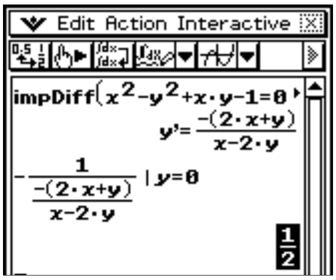
Question 13 Answer: C

$$\frac{dy}{dx} = \frac{2x+y}{2y-x}$$

Gradient of normal = $\frac{x-2y}{2x+y}$

At $y = 0$, $\frac{x-2y}{2x+y} = \frac{1}{2}$





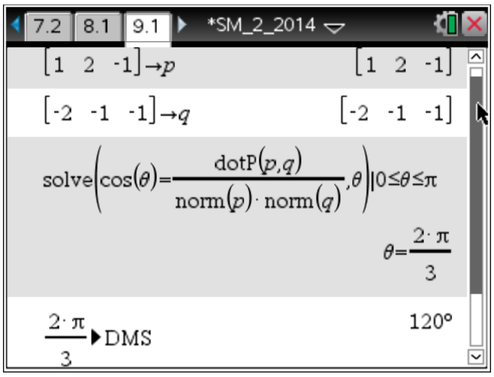
Question 14 Answer: A

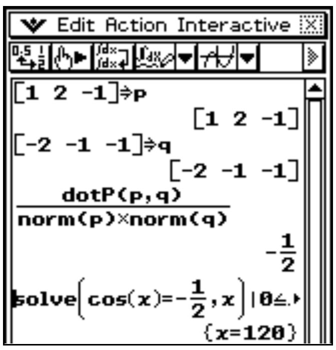
$$\underset{\sim}{p} \cdot \underset{\sim}{q} = |\underset{\sim}{p}||\underset{\sim}{q}|\cos(\theta)$$

$$-3 = \sqrt{6} \times \sqrt{6} \cos(\theta)$$

$$\cos(\theta) = -\frac{1}{2}$$

$$\theta = 120^\circ$$





Question 15 Answer: C

Consider Option C

$$\text{LHS} = \left(\overrightarrow{AC} - \overrightarrow{AB}\right) \cdot \overrightarrow{AB}$$

$$= \overrightarrow{BC} \cdot \overrightarrow{AB}$$

$$= \left|\overrightarrow{BC}\right|\left|\overrightarrow{AB}\right|\cos(\theta)$$

$$\text{RHS} = \left|\overrightarrow{BC}\right|^2 \neq \text{LHS}$$

Question 16 Answer: B

$x = \cos(2t) = 1 - 2\sin^2(t)$ … equation 1

$y = -2\sin(t) \Leftrightarrow \sin(t) = -\frac{y}{2}$ … equation 2

Substituting equation 2 in equation 1

$$x = 1 - 2 \times \frac{y^2}{4}$$

$$y^2 + 2x - 2 = 0$$

Question 17 Answer: A

$$\frac{dy}{dx} = -12\int x\,dx = -6x^2 + c$$

$\frac{dy}{dx} = -1$ at $x = -1$, therefore $c = 5$

$$y = \int\left(-6x^2 + 5\right)dx = -2x^3 + 5x + c_1$$

$y = 4$ at $x = -1$, therefore $c_1 = 7$

$$y = -2x^3 + 5x + 7$$

Question 18 Answer: D

When the ball hits the ground, $y = 0$, therefore

$$20t - 5t^2 = 5t(4-t) = 0$$

$t = 0$ or 4. The ball hits the ground at $t = 4$.

The horizontal distances travelled is

$35 \times 4 = 140$

Question 19 Answer: C

The displacement from the origin can be found by calculating the signed area between the graph and the horizontal axis.

$$(4\times3) + (2\times1) + \frac{1}{2}\left((1\times3) + (2\times2) - (6\times2)\right) = \frac{23}{2}$$

The coordinates are $\left(\frac{23}{2}, 0\right)$

Question 20 **Answer: D**

$$\frac{d}{dx}\left(\frac{1}{2}v^2\right) = \frac{9}{x^2}$$

$$\int d\left(\frac{1}{2}v^2\right) = \int\left(\frac{9}{x^2}\right)dx$$

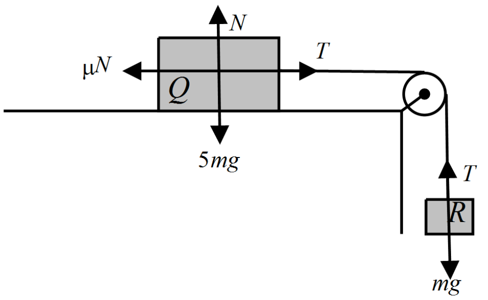
$$\frac{1}{2}v^2 = -\frac{9}{x} + c$$

When $x = 9$, $v = -2$, therefore $c = 3$

$$\frac{1}{2}v^2 = \frac{3x-9}{x}$$

$$v = -\sqrt{\frac{6x-18}{x}}$$ (N.B. $v = -2$ when $x = 9$)

Question 21 **Answer: E**



$\underset{\sim}{R} = m\underset{\sim}{a}$ for Q: $T - \frac{1}{10} \times 5mg = 5ma$ (eqn. 1)

$\underset{\sim}{R} = m\underset{\sim}{a}$ for R: $mg - T = ma$ (eqn. 2)

Add equations 1 and 2

$$\frac{mg}{2} = 6ma$$

$$a = \frac{g}{12}$$

Question 22 **Answer: B**

$$-mg - mkv^2 = ma$$

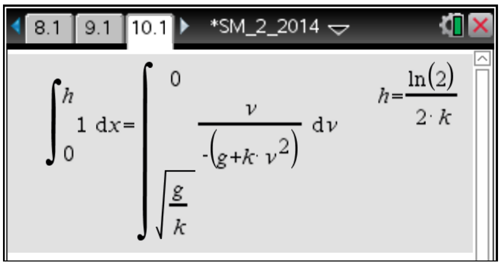
$$-\left(g + kv^2\right) = v\frac{dv}{dx}$$

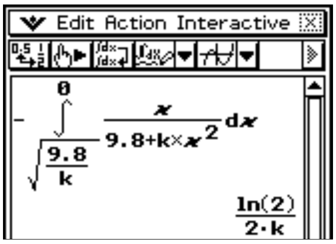
When $x = 0$, $v = \sqrt{\frac{g}{k}}$ and when $x = h$, $v = 0$, where h is the maximum height.

$$-\left(g + kv^2\right) = v\frac{dv}{dx}$$

$$\int_0^h dx = -\int_{\sqrt{\frac{g}{k}}}^{0} \frac{v}{g + kv^2}\,dv$$

$$h = \frac{\log_e(2)}{2k}$$





END OF SECTION 1 SOLUTIONS

SECTION 2: Extended Response SOLUTIONS

Question 1

1a.i.

$w = 4 - 4i$

$|w| = \sqrt{4^2 + (-4)^2} = \sqrt{32} = 4\sqrt{2}$, as required. 1M

1a.ii.

$\arg(w) = \tan^{-1}\left(\frac{-4}{4}\right) = \tan^{-1}(-1) = -\frac{\pi}{4}$ 1M

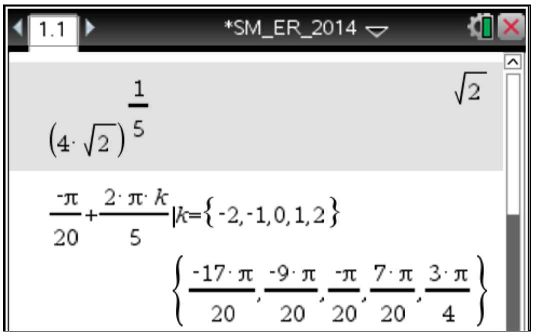
1b.

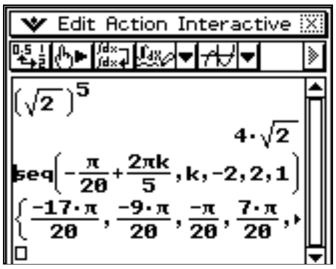
$z^5 = 4\sqrt{2}\,\text{cis}\left(-\frac{\pi}{4}\right)$ 1M (de Moivre's theorem)

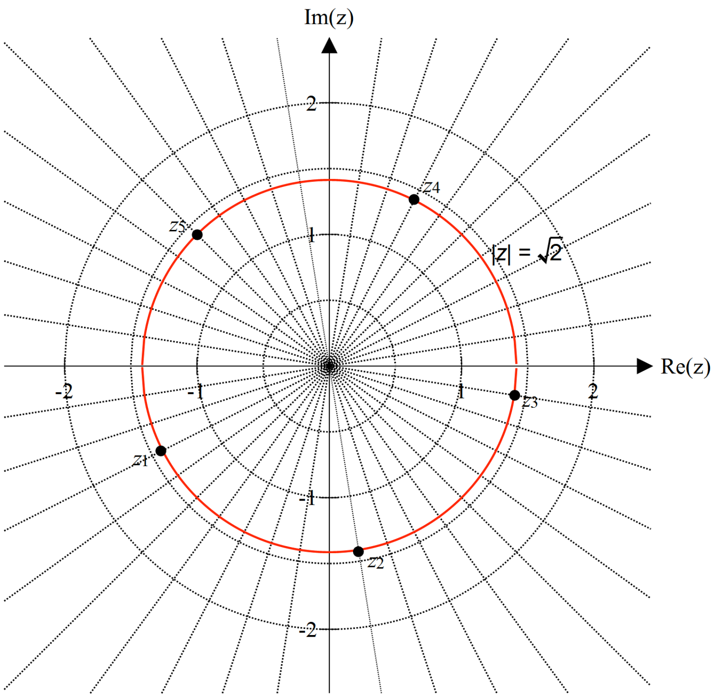
$z = \left(4\sqrt{2}\right)^{\frac{1}{5}}\text{cis}\left(-\frac{\pi}{20} + \frac{2k\pi}{5}\right), k = -2, -1, 0, 1, 2$ 1M (5 solutions with $a = \sqrt{2}$)

$z = \sqrt{2}\,\text{cis}\left(-\frac{17\pi}{20}\right)$ or $z = \sqrt{2}\,\text{cis}\left(-\frac{9\pi}{20}\right)$ or $z = \sqrt{2}\,\text{cis}\left(-\frac{\pi}{20}\right)$ or $z = \sqrt{2}\,\text{cis}\left(\frac{7\pi}{20}\right)$ or $z = \sqrt{2}\,\text{cis}\left(\frac{3\pi}{4}\right)$

1A (five correct solutions with $\theta \in (-\pi, \pi]$)







1c.i.
1A (Circle centred at the origin with radius $\sqrt{2}$ - i.e. slightly less than the 1.5 on the scale provided),
1c.ii.
1A (5 points with correct angles on the circle of radius $\sqrt{2}$)

1d.
Method 1 (by hand)

$u = \sqrt{3} - i$

$|u| = 2$ and $\arg(u) = -\frac{\pi}{6}$

Using de Moivre's theorem,

$u^k = 2^k\left(\cos\left(-\frac{k\pi}{6}\right) + i\sin\left(-\frac{k\pi}{6}\right)\right)$ 1M

When $u^k \in R^+$,

$\text{Im}\left(u^k\right) = \sin\left(-\frac{k\pi}{6}\right) = 0$

Therefore, $k = 6n$, where n is a positive integer. 1M

But $\cos\left(-\frac{(6n)\pi}{6}\right)$ is positive only when n is an even integer.

Therefore the least value of k is $6 \times 2 = 12$. 1A

Method 2 (CAS-assisted)

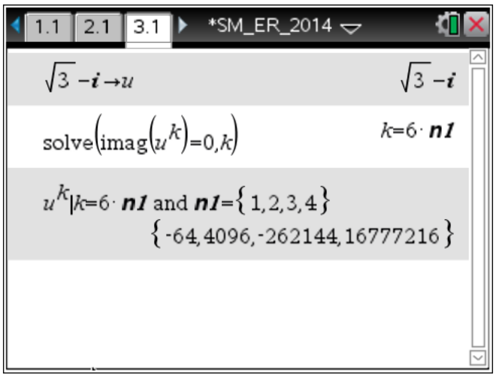
Solve for k, $\text{Im}\left(u^k\right) = 0$ 1M

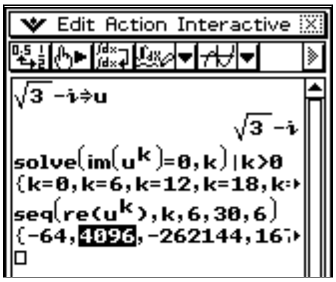
$k = 6n$, where n is a positive integer

When $n = 1$, $u^k = -64 \notin R^+$ 1M (show that k is a positive multiple of 6)

When $n = 2$, $u^k = 4096 \in R^+$

Therefore the least value of k is $6 \times 2 = 12$. 1A





Method 3 (‘Guess and check’)
‘Guess and check’ without other relevant working attracts only 1 mark out of 3 marks.
The least value of k is 12. 1A

1e.

Let $P(z) = z^9 + 16(1+i)z^3 + c + id$

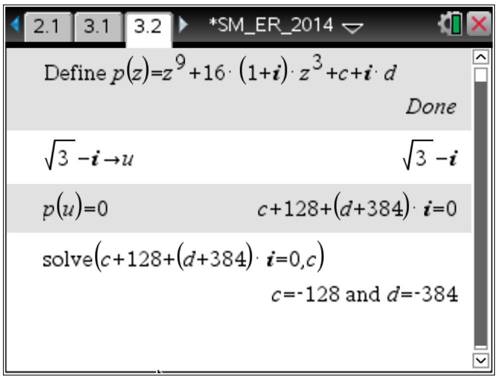
If $u = \sqrt{3} - i$ is a root of $P(z)$, then

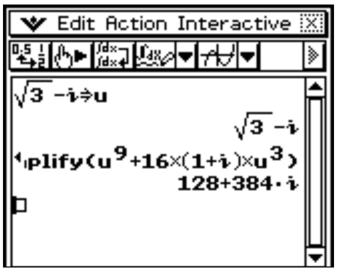
$P(u) = u^9 + 16(1+i)u^3 + c + id = 0$ 1M

Therefore, $(c+128) + i(d+384) = 0 + i0$ 1M

Equating real and imaginary parts

$c = -128$ and $d = -384$ 1A



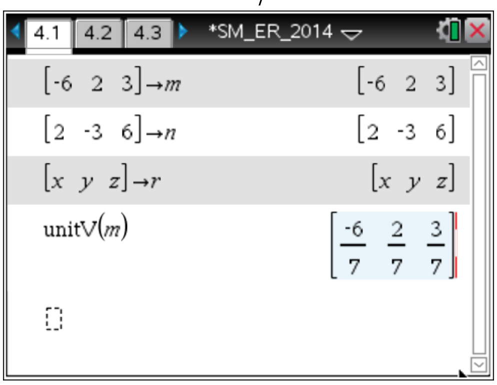


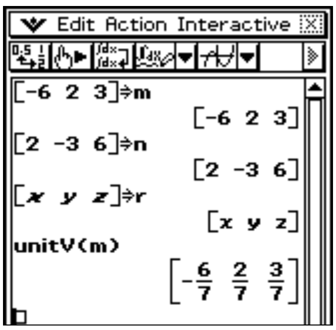
Question 2

2a.

$|\underset{\sim}{m}| = \sqrt{49} = 7$, hence $\hat{\underset{\sim}{m}} = \frac{1}{7}\left(-6\underset{\sim}{i} + 2\underset{\sim}{j} + 3\underset{\sim}{k}\right)$

Therefore, $\cos(\phi) = \frac{2}{7}$ 1A





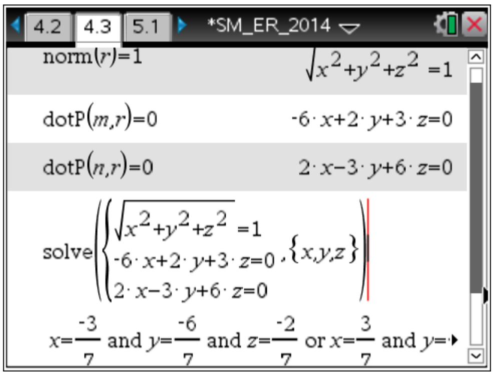
2b.

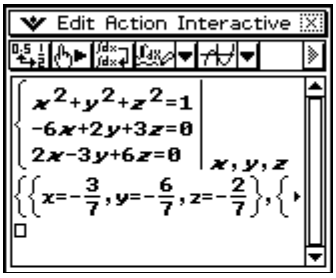
$\left|\hat{\underset{\sim}{r}}\right| = \sqrt{x^2 + y^2 + z^2} = 1$ 1M

$\underset{\sim}{m} \cdot \hat{\underset{\sim}{r}} = -6x + 2y + 3z = 0$ and $\underset{\sim}{n} \cdot \hat{\underset{\sim}{r}} = 2x - 3y + 6z = 0$ 1M

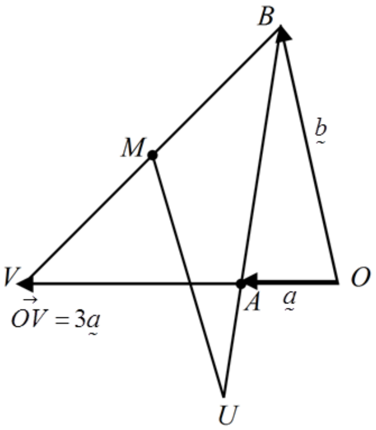
Solve the three equations simultaneously for x, y and z

$x = \frac{3}{7},\ y = \frac{6}{7},\ z = \frac{2}{7}$ or $x = -\frac{3}{7},\ y = -\frac{6}{7},\ z = -\frac{2}{7}$ 1A





2c.



2c.i.

$\overrightarrow{BA} = \underset{\sim}{a} - \underset{\sim}{b}$ 1A

2c.ii.

$\overrightarrow{BM} = \frac{1}{2}\left(3\underset{\sim}{a} - \underset{\sim}{b}\right)$ 1A

2d.

$\overrightarrow{MU} = \overrightarrow{MB} + \overrightarrow{BU}$

$= -\overrightarrow{BM} + p\,\overrightarrow{BA}$ 1M

$= -\frac{1}{2}\left(3\underset{\sim}{a} - \underset{\sim}{b}\right) + p\left(\underset{\sim}{a} - \underset{\sim}{b}\right)$

$= \left(p - \frac{3}{2}\right)\underset{\sim}{a} + \left(\frac{1}{2} - p\right)\underset{\sim}{b}$ 1A

2e.

Let N be the midpoint of the line segment OV, which is where MU intersects OV.

Need to prove that $\overrightarrow{NM}$ can be expressed in terms of $\underset{\sim}{b}$.

$\overrightarrow{NV} = \frac{1}{2}\overrightarrow{OV} = \frac{3}{2}\underset{\sim}{a}$

$\overrightarrow{NM} = \overrightarrow{NV} + \overrightarrow{VM}$

$= \overrightarrow{NV} - \overrightarrow{BM}$ 1M

$= \frac{3}{2}\underset{\sim}{a} - \left(\frac{3}{2}\underset{\sim}{a} - \frac{1}{2}\underset{\sim}{b}\right)$

$\overrightarrow{NM} = \frac{1}{2}\underset{\sim}{b}$ and $\overrightarrow{OB} = \underset{\sim}{b}$ 1M

Therefore line segment *OB* is parallel to *NM*, and consequently also parallel to *MU*.

2f.

$\overrightarrow{NM} = \frac{1}{2}\underset{\sim}{b}$, therefore $\overrightarrow{MU}$ can also be expressed in terms of $\underset{\sim}{b}$ only (i.e. $\overrightarrow{MU}$ parallel to $\overrightarrow{OB} = \underset{\sim}{b}$).

However, from part **d.**, $\overrightarrow{MU} = \left(p - \frac{3}{2}\right)\underset{\sim}{a} + \left(\frac{1}{2} - p\right)\underset{\sim}{b}$.

Therefore $\left(p - \frac{3}{2}\right)\underset{\sim}{a} = \underset{\sim}{0}$, and $p - \frac{3}{2} = 0$ 1M

$p = \frac{3}{2}$ 1A

Question 3

3a.

$x = \cos(t)$ and $y = \sin(t)$

Using the identity $\cos^2(t) + \sin^2(t) = 1$,

$x^2 + y^2 = 1$

This is the equation of a circle of unit radius, as required 1M

3b.

K is the area of the sector such that the arc length *LM* is *t* and the angle subtended at the centre is t^c. 1M

$K = \frac{t}{2\pi} \times \left(\pi \times 1^2\right)$

$K = \frac{t}{2}$

1A

3c.

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

$\text{LHS} = x^2 - y^2$

$= \left(\frac{1}{2}\left(e^t + e^{-t}\right)\right)^2 - \left(\frac{1}{2}\left(e^t - e^{-t}\right)\right)^2$ 1M

$= \frac{1}{4}\left(\left(e^{2t} + 2 + e^{-2t}\right) - \left(e^{2t} - 2 + e^{-2t}\right)\right)$

$= \frac{1}{4}(4) = 1 = \text{RHS}$, as required 1M

3d.

Area of triangle *ONQ*

$$A + B = \frac{1}{2}\left(\frac{1}{2}\left(e^{t} + e^{-t}\right) \times \frac{1}{2}\left(e^{t} - e^{-t}\right)\right)$$

$$A + B = \frac{e^{2t} - e^{-2t}}{8} \quad \text{1A}$$

Given that $A = \dfrac{e^{-2t}\left(e^{4t} - 4te^{2t} - 1\right)}{8}$,

$$B = \frac{e^{2t} - e^{-2t}}{8} - \frac{e^{-2t}\left(e^{4t} - 4te^{2t} - 1\right)}{8} \quad \text{1M}$$

$$B = \frac{4t}{8} = \frac{t}{2} \quad \text{1A}$$

Note the analogous results of area *K* for the circle with equation $x^2 + y^2 = 1$ and area *B* for the hyperbola with equation $x^2 - y^2 = 1$.

3e.

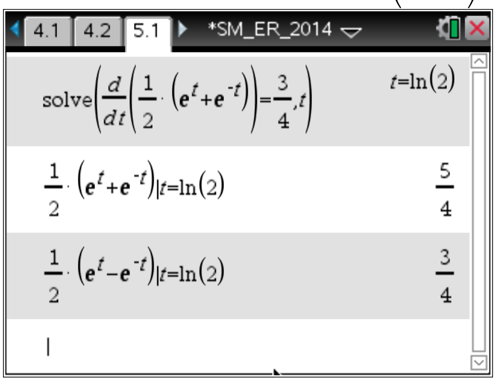
Solve for *t*, $\frac{d}{dt}\left(\frac{1}{2}\left(e^{t} + e^{-t}\right)\right) = \frac{3}{4}$

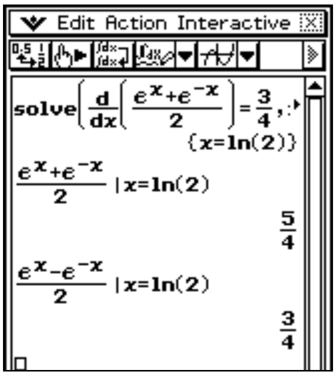
$t = \log_e(2)$ 1M

Substitute $t = \log_e(2)$ in *x* and *y*

$x = \frac{5}{4}$ and $y = \frac{3}{4}$

The cartesian coordinates are $\left(\frac{5}{4}, \frac{3}{4}\right)$ 1A





3f.

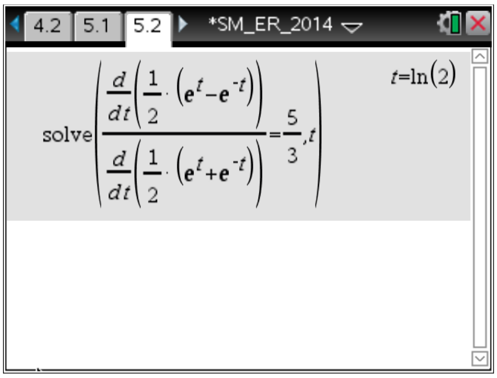
At $t = a$ the gradient of the normal is $-\frac{3}{5}$, therefore

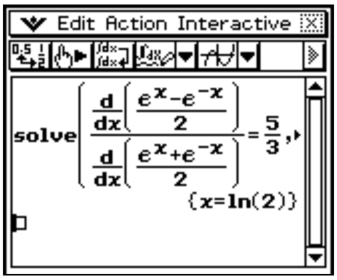
$$\frac{dy}{dx} = \frac{5}{3}$$

$$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx} \quad \text{1M}$$

Solve for *t*, $\frac{dy}{dt} \times \frac{dt}{dx} = \frac{5}{3}$

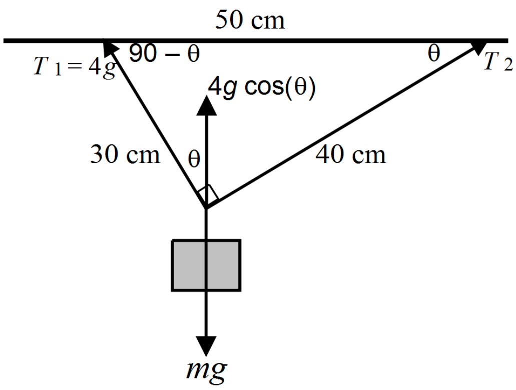
$a = \log_e(2)$ 1A





Question 4

4a.



Resolving forces parallel to the 4g tension force.

$4g = mg\cos(\theta)$ 1M

$4 = m \times \frac{40}{50}$

$m = 5$ 1A

4b.

Resolving forces perpendicular to the 4g tension force.

$T = 5g\sin(\theta)$

$T = 5g \times \frac{30}{50} = 3g$ 1A

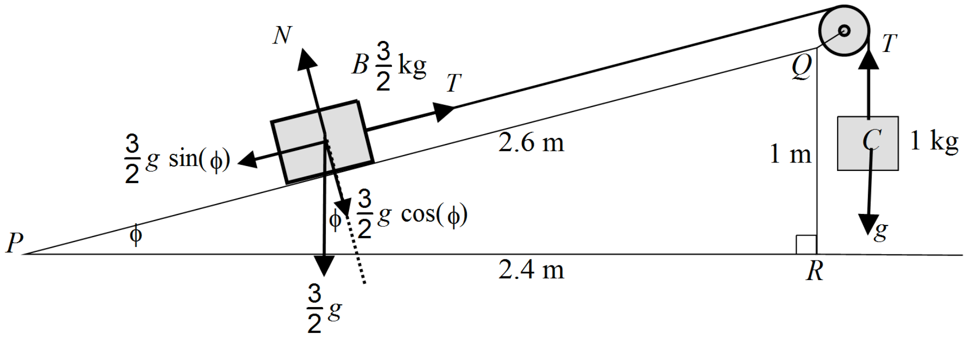
Alternatively,

$mg = \frac{T_1}{\cos(\theta)} = \frac{T_2}{\sin(\theta)}$

$T_2 = T_1 \tan(\theta)$

$T_2 = 4g \times \frac{30}{40} = 3g$

4c.
The sides of triangle *PQR* are in the ratio of the pythagorean triple (5, 12, 13).



$\underset{\sim}{R} = m\underset{\sim}{a}$ for block *B*: $T - \frac{3}{2}g\sin(\phi) = \frac{3}{2}a$ (equation 1)

$\underset{\sim}{R} = m\underset{\sim}{a}$ for *C*: $g - T = a$ (equation 2) 1M

Adding equations 1 and 2

$g - \frac{3}{2}g \times \frac{5}{13} = \frac{5}{2}a$

$\frac{5}{2}a = g - \frac{15}{26}g$

$\frac{5}{2}a = \frac{11}{26}g$ 1M

$a = \frac{11}{65}g \text{ ms}^{-2}$

4d.i.

$v^2 = u^2 + 2as$

$v^2 = 0^2 + 2 \times \frac{11 \times 9.8}{65} \times 1$ 1M

$v = 1.82 \text{ ms}^{-1}$ 1A

4d.ii.
The acceleration of *B* just after the string becomes slack:

$\underset{\sim}{R} = m\underset{\sim}{a}$

$\frac{3}{2}a = -\frac{3}{2}g \times \sin(\phi)$

$a = -9.8 \times \frac{5}{13}$

$a = -3.77 \text{ ms}^{-2}$

The magnitude of the acceleration is 3.77 ms^{-2} 1A

4d.iii.
Find the distance travelled up the plane by *B* after the string becomes slack

$v^2 = u^2 + 2as$

$0^2 = (1.824...)^2 + 2 \times (-3.769...)s$ 1M

$s = 0.44$ m

Total distance that *B* travels up the plane = 1.44 metres 1A

Question 5

5a.

$v = u + at$

$v_0 = 0 + g \times 10$

$v_0 = 10g = 98\,\text{ms}^{-1}$ 1A

5b.

$v(6) = (98 - 4)e^{-\frac{9.8\times 6}{4}} + 4$

$v(6) = 4.0\ \text{ms}^{-1}$ 1A

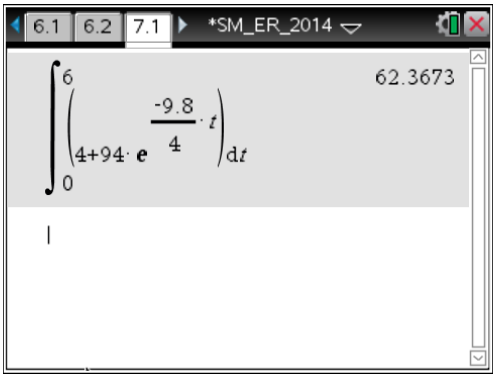
This shows that Lin hit the ground at terminal velocity, i.e. as $t \to \infty$, $(v_0 - 4)e^{-\frac{g}{4}t} \to 0$ and $v(t) \to 4$.

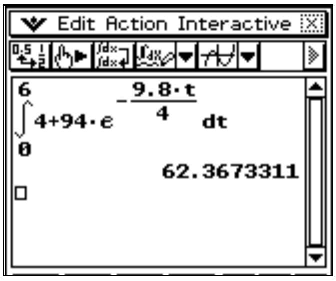
5c.

$\frac{dx}{dt} = (v_0 - 4)e^{-\frac{g}{4}t} + 4$

$x = \int_0^6 \left(94e^{-\frac{9.8}{4}t} + 4\right) dt$ 1M

$x = 62.4$ m 1A





5d.

Distance travelled during free fall:

$s = ut + \frac{1}{2}at^2$

$s = 0 + 4.9 \times 10^2 = 490$ m 1A

Total distance travelled from balloon to the ground:

$490 + 62.4 = 552.4\,\text{m}$ 1A

5e.

$m\frac{dv}{dt} = mg - kv$

$\int dt = -m\int \frac{dv}{kv - mg}$ 1M

$t = -\frac{m}{k}\log_e\left(|kv - mg|\right) + c$

When $t=0, v=u$, therefore

$c=\frac{m}{k}\log_e\left(\left|ku-mg\right|\right)$ 1M

Therefore,

$$t=-\frac{m}{k}\log_e\left(\left|\frac{kv-mg}{ku-mg}\right|\right)$$

$$kv=\left(ku-mg\right)\times e^{-\frac{k}{m}t}+mg$$

$v=\frac{mg}{k}+\left(u-\frac{mg}{k}\right)\times e^{-\frac{k}{m}t}$, as required 1M

5f.

As $t\to\infty$, $\left(\frac{mg}{k}+\left(u-\frac{mg}{k}\right)\times e^{-\frac{k}{m}t}\right)\to 4.2$

Therefore, $\frac{mg}{k}=4.2$

$k=\frac{90\times 9.8}{4.2}=210$ 1A

END OF SECTION 2 SOLUTIONS

