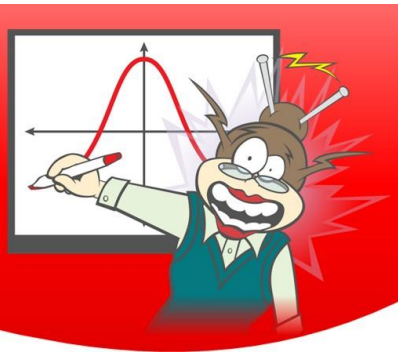


Specialist Mathematics Exam Preparation MC Questions

Poll Question

The subset of the complex plane defined by the complex equation $\left|\frac{z-2}{z+2}\right|=1$ is

A. a circle
B. an ellipse
C. a ray
D. a straight line
E. a hyperbola

Question: 1.

The asymptotes of the hyperbola $\frac{(x-2)^2}{9}-\frac{(y+3)^2}{25}=1$ have equations

A. $y=\frac{5}{3}x+\frac{4}{3}$ and $y=-\frac{5}{3}x-\frac{16}{3}$

B. $y=\frac{5}{3}x-\frac{4}{3}$ and $y=\frac{5}{3}x-\frac{16}{3}$

C. $y=\frac{3}{5}x+\frac{4}{3}$ and $y=-\frac{3}{5}x-\frac{16}{3}$

D. $y=\frac{5}{3}x-\frac{19}{3}$ and $y=-\frac{5}{3}x+\frac{1}{3}$

E. $y=\frac{3}{5}x-\frac{4}{3}$ and $y=-\frac{5}{3}x+\frac{4}{3}$

Question: 2.

Which of the following is an even function?

A. $f(x)=\text{cosec}(x)$

B. $f(x)=\arcsin(|x|)$

C. $f(x)=\arctan(x)+1$

D. $f(x)=\arccos(x)$

E. $f(x)=\sec\left(x-\frac{\pi}{4}\right)$

Author: Bozenna Graham

Question: 3.

Consider the circle $|z+3-2i|=2$. Which of the following lines intersects the circle exactly twice?

A. $\text{Im}(z)=0$
B. $\text{Re}(z)=1$
C. $|z+3-2i|=|z-5|$
D. $|z+3-2i|=|z+8i|$
E. $|z+3-2i|=|z+1+i|$

Question: 4.

The sum and product of the roots of the equation $z^5+z^4+z^3+z^2+z+1=0,\ z\in C$ are respectively:

A. $-1,-1$
B. $-1,0$
C. $0,-1$
D. $1,-1$
E. $-1,1$

Question: 5.

If $z=(1-i)^n$ and $|z|=32$ then

A. $n=8$
B. $n=10$
C. $n=5$
D. $n=4$
E. $n=2$

Question: 6.

The complex number $z=k\left(\cos\frac{\pi}{m}+i\sin\frac{\pi}{m}\right)$ is a root of the equation $z^3=w$. Given $w=4-4\sqrt{3}\,i$ then

A. $k=1,m=3$
B. $k=2,m=3$
C. $k=2,m=-9$
D. $k=3,m=9$
E. $k=\frac{1}{2},m=-9$

Author: Bozenna Graham

Question: 7.

The solution of differential equation $\frac{dy}{dx} = e^{2x}\left(1+y^2\right)$ given that $x=0$ when $y=1$ is

A. $y = \tan\left(\frac{e^{2x}}{2} - \frac{\pi}{4} + \frac{1}{2}\right)$

B. $y = \tan\left(\frac{e^{2x}}{2} + \frac{\pi}{4} + \frac{1}{2}\right)$

C. $y = \arctan\left(\frac{e^{2x}}{2} + \frac{\pi}{4}\right)$

D. $y = \tan\left(\frac{e^{2x}}{2} + \frac{\pi}{4} - \frac{1}{2}\right)$

E. $y = \arctan\left(\frac{e^{2x}}{2} + \frac{\pi}{4} - \frac{1}{2}\right)$

Question: 8.

The velocity, v, of the particle P, at time t is given by $v(t) = e^{3t} - 2e^{t}$. The distance covered by P between $t=0$ and $t=\log_e 3$ is closest to

A. 4.7
B. 5.1
C. 5.2
D. 12.7
E. 0.8

Question: 9.

A curve is defined by the equation $4x^2 + 9y^2 = 36$. The section of the curve in the first quadrant is rotated through 360° about the y-axis to form a solid of revolution with volume equal to

A. 4π
B. 8π
C. 12π
D. 16π
E. 9π

Author: Bozenna Graham

Question: 10.

The vectors $\underset{\sim}{a} = -\underset{\sim}{i} + 2\underset{\sim}{j} + 2\underset{\sim}{k}$, $\underset{\sim}{b} = \underset{\sim}{i} - 3\underset{\sim}{j} + \underset{\sim}{k}$ and $\underset{\sim}{c} = \lambda\underset{\sim}{i} - 5\underset{\sim}{j} - 2\underset{\sim}{k}$ are **linearly dependent** when the value of λ is

A. $-\frac{53}{12}$

B. $\frac{17}{8}$

C. $-\frac{5}{8}$

D. $\frac{8}{17}$

E. $\frac{5}{8}$

Question: 11.

A particle is moving along a curve defined by the following parametric equations

$$x(t) = \sec(t)$$
$$y(t) = \sin(t)$$

where $0 \le t \le \pi$.

The equation of the tangent to the curve at $t = \frac{\pi}{6}$ is

A. $y = \frac{3\sqrt{3}}{4}x - \frac{1}{2}$

B. $y = \frac{3\sqrt{3}}{4}x - 1$

C. $y = \frac{3\sqrt{3}}{4}x + 1$

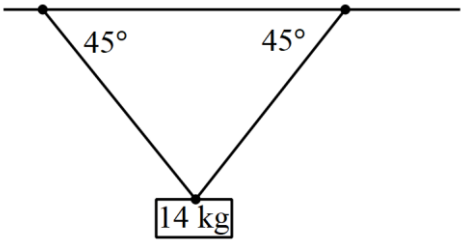
D. $y = \frac{3\sqrt{3}}{4}x$

E. $y = \frac{3\sqrt{3}}{2}x - 1$

Author: Bozenna Graham

Question: 12.

A 14 kg mass is suspended in equilibrium from a horizontal ceiling by two identical light strings. Each string makes an angle of 45° with the ceiling as shown in the diagram.



The magnitude, in newtons, of the tension in each string is equal to

A. $14\sqrt{2}$
B. $7\sqrt{2}$
C. $14\sqrt{2}g$
D. $\frac{7g}{\sqrt{2}}$
E. $7\sqrt{2}g$

Question: 13.

The length of arc of the graph of $f:[0,4]\to R,\ f(x)=\arctan(x)+1$, correct to 3 decimal places is:

A. 4.345
B. 4.350
C. 18.880
D. 4.620
E. 4.068

Question: 14.

Euler's method, with a step size of 0.2, is used to approximate the solution of the differential equation $\frac{dy}{dx}=x-y^2$, with $y=0$ when $x=1$. The estimated value of y, to five decimal places, when $x=2$ is

A. 1.00233
B. 1.09090
C. 1.09091
D. 1.10033
E. 0.01033

Author: Bozenna Graham

Question: 15.

The position vector $\underset{\sim}{r}(t)$ of a mass of 5 kg after t seconds, where $t \geq 0$, is given by

$$r(t) = \sin(2t)\underset{\sim}{i} + \cos(t)\underset{\sim}{j} + \frac{5}{3}t^3\underset{\sim}{k}.$$

The force, in newtons, acting on the mass when $t = \pi$ seconds is

A. $5\underset{\sim}{j} + 50\pi\underset{\sim}{k}$

B. $\underset{\sim}{j} + 10\pi\underset{\sim}{k}$

C. $2\underset{\sim}{i} + 5\pi\underset{\sim}{j}$

D. $25\pi\underset{\sim}{k}$

E. $2\underset{\sim}{j} + 5\pi\underset{\sim}{k}$

Question: 16.

Domain and range of $h(x) = \dfrac{3}{\sqrt{\arcsin(2x)}}$ are, respectively

A. $\left[-\frac{1}{2}, \frac{1}{2}\right]$ and $\left[\frac{3\sqrt{2}}{\sqrt{\pi}}, \infty\right)$

B. $\left(0, \frac{1}{2}\right]$ and $\left[\frac{3\sqrt{2}}{\sqrt{\pi}}, \infty\right)$

C. $\left[0, \frac{1}{2}\right]$ and $\left(\frac{3\sqrt{2}}{\sqrt{\pi}}, \infty\right)$

D. $\left[0, \frac{1}{2}\right)$ and $\left(\frac{3\sqrt{2}}{\sqrt{\pi}}, \infty\right)$

E. $\left(0, \frac{1}{2}\right)$ and $\left(\frac{3\sqrt{2}}{\sqrt{\pi}}, \infty\right)$

Question: 17.

If α is acute and $\cos(2\alpha) = \frac{3}{4}$, then $\operatorname{cosec}(\alpha)$ is

A. $\dfrac{1}{2\sqrt{2}}$

B. $\dfrac{\sqrt{2}}{\sqrt{7}}$

C. $\dfrac{5}{4}$

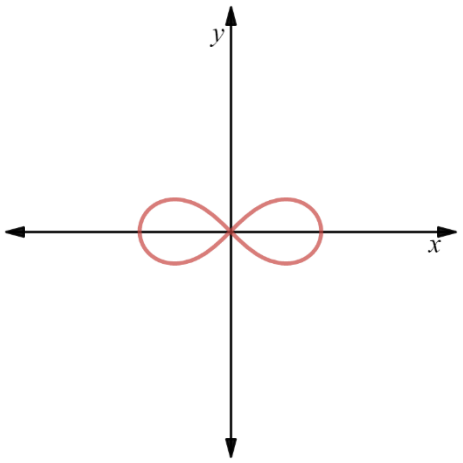
D. $2\sqrt{2}$

E. $\sqrt{2}$

Author: Bozenna Graham

Question: 18.

The graph shows the relation $\left(x^2+y^2\right)^2 = x^2 - y^2$.



Point P lies in the first quadrant and the tangent to the graph at P is horizontal. The coordinates of P are

A. $\left(\frac{\sqrt{6}}{2}, \frac{\sqrt{2}}{2}\right)$

B. $\left(\frac{\sqrt{3}}{4}, \frac{\sqrt{2}}{4}\right)$

C. $\left(\frac{\sqrt{3}}{2}, \frac{\sqrt{2}}{2}\right)$

D. $\left(\frac{\sqrt{6}}{4}, \frac{\sqrt{2}}{4}\right)$

E. $(1,0)$

Question: 19.

Which of the following is true for the graph of $y = \frac{x^2+2x}{x^2-1}$

A. no points of inflection and two asymptotes
B. three asymptotes and one point of inflection
C. two asymptotes and one point of inflection
D. three asymptotes and no points of inflection
E. two asymptotes and no stationary points

Question: 20.

A particle moves in a straight line such that its velocity, v ms^{-1}, at time t seconds is given by

$$v(t) = \begin{cases} 6t - t^2, & \text{for } 0 \le t \le 5 \\ \frac{1}{2}(15 - t), & \text{for } t > 5 \end{cases}$$

The particle returns to its initial position at $t = T$.

The value of T, to three decimal places, is

A. 31.234
B. 30.275
C. 14.550
D. 29.550
E. 30.272

Author: Bozenna Graham

Question: 21.

A particle of mass 3 kg is traveling along a path so that its position vector, r, in metres, at time, t, in seconds, is $\underset{\sim}{r}(t) = 2t^3\,\underset{\sim}{i} - 3t^2\,\underset{\sim}{j} + t\,\underset{\sim}{k}$.

The magnitude, to the nearest integer, of momentum, in kg ms^{-1}, of the particle at $t = 3$ is

A. 171
B. 445
C. 148
D. 454
E. 154

Question: 22

Evaluate the following $i + i^2 + i^3 + i^4 + \ldots + i^{199} + i^{200} + i^{201}$

A. 0 B. -1 C. i D. $-i$ E. 1

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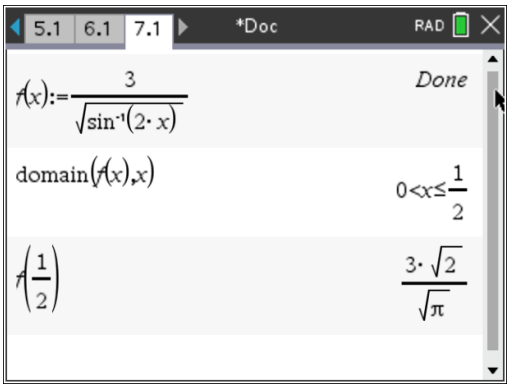
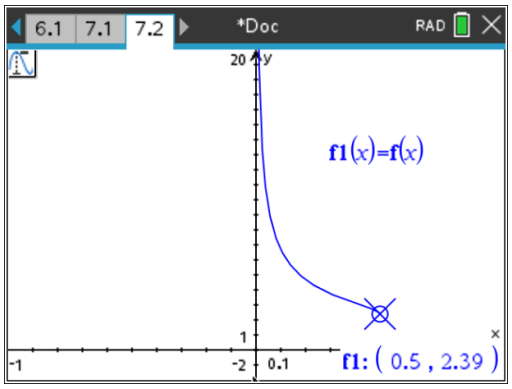
Answers

Question 16 Option B

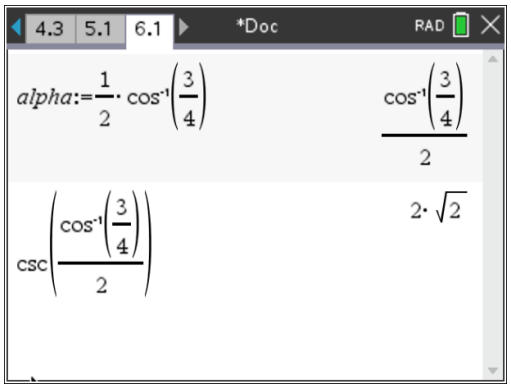




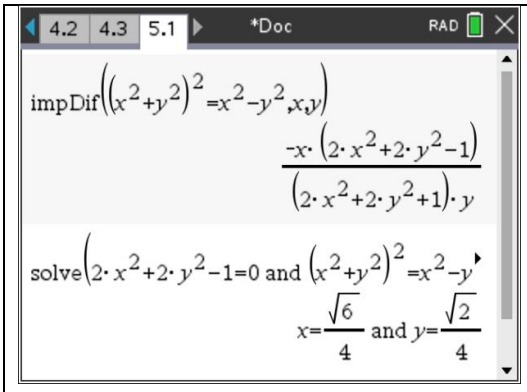
Domain: $\left(0,\frac{1}{2}\right]$

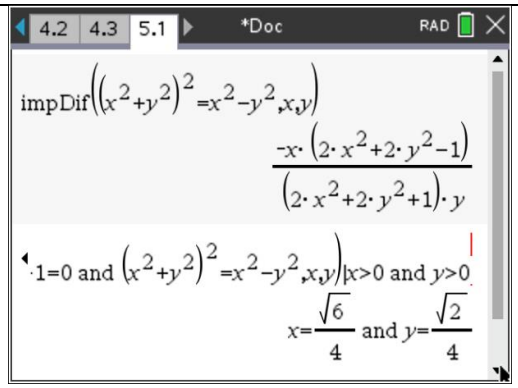
Range: $\left[\frac{3\sqrt{2}}{\sqrt{\pi}},\infty\right)$

Question 17 Option D



Question 18 Option D





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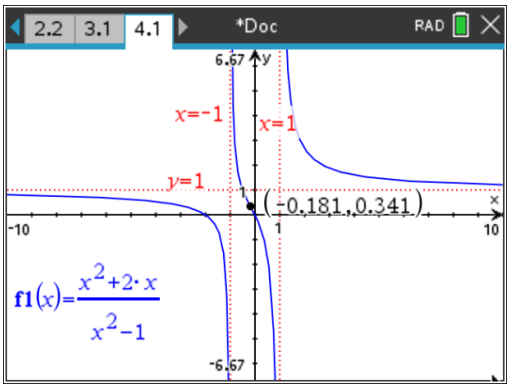
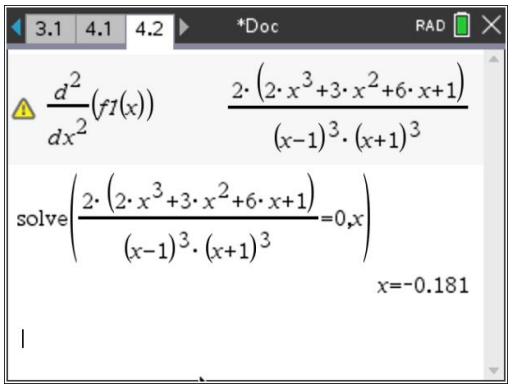
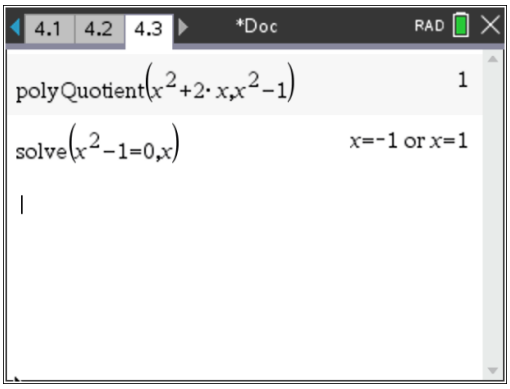
Question 19 Option B



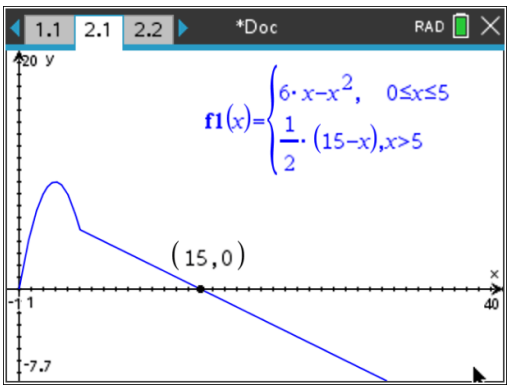
Point of inflection:

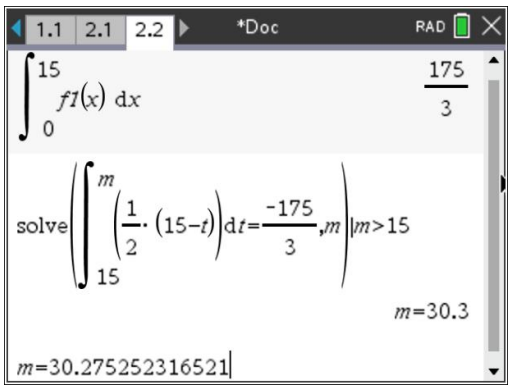


Asymptotes:



Question 20 Option B





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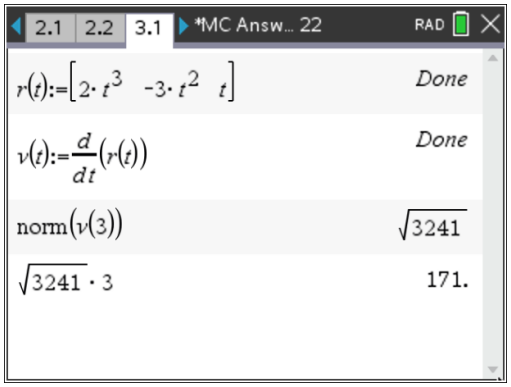
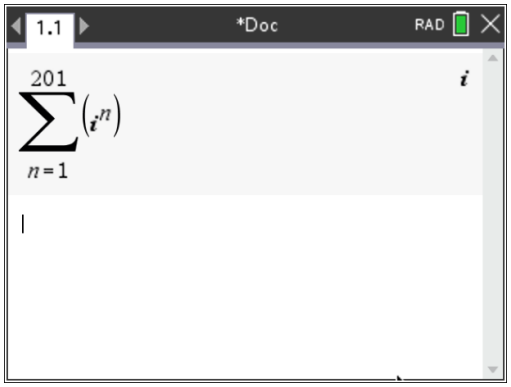
Question 21 Option A



Question 22 Option C



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