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PRACTICE EXAM 1

INSTRUCTIONS

Answer **all** questions in the spaces provided.
A decimal approximation **will not** be accepted if an exact answer is required.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, diagrams in this book **are not** drawn to scale.
Take the **acceleration due to gravity** to have magnitude g m/s^2, where $g = 9.8$

Question 1

Let $u = 10 - 5i$ and $v = 2 - i$.
Find $\dfrac{iu}{\overline{v}}$ in Cartesian form.

2 MARKS

Question 2

The position of particles A and B at any time t seconds, $t \geq 0$, is given by
$\underset{\sim}{r}_A(t) = (t^2 - 2t)\underset{\sim}{i} + (6t - 2)\underset{\sim}{j}$ and $\underset{\sim}{r}_B(t) = (5t - 12)\underset{\sim}{i} + (t^2 + 6)\underset{\sim}{j}$, respectively.
Determine the time when the particles collide.

Question 10 D

Vertical asymptote at $x = 2$ This is not one of the alternatives given.

Do long division to find another asymptote

$$x-2\overline{)3x^2+x-2}\quad 3x+7$$

$$3x^2-6x$$

$$7x-2$$

$$7x-14$$

$$12$$

$$y=\frac{3x^2+x-2}{x-2}=3x+7+\frac{12}{x-2}$$

$y = 3x + 7$ is another asymptote

Question 11 C

$$\frac{d}{dx}\left(\log_e\sqrt{3-2x}\right)$$

Let $u=\sqrt{3-2x}=(3-2x)^{\frac{1}{2}}$

$$\Rightarrow \frac{du}{dx}=\frac{1}{2}(3-2x)^{-\frac{1}{2}}(-2)=-(3-2x)^{-\frac{1}{2}}$$

$$\frac{d}{dx}\left(\log_e\sqrt{3-2x}\right)=\frac{-(3-2x)^{-\frac{1}{2}}}{(3-2x)^{\frac{1}{2}}}$$

$$=\frac{-1}{(3-2x)}$$

$$=\frac{1}{2x-3}$$

Question 12 B

If $y = x\cos(x)$

then $\frac{dy}{dx}=\cos(x)-x\sin(x)$

and $\frac{d^2y}{dx^2}=-\sin(x)-(\sin(x)+x\cos(x))=-2\sin(x)-x\cos(x)$

$$\Rightarrow \frac{d^2y}{dx^2}+y=-2\sin(x)-x\cos(x)+x\cos(x)=-2\sin(x)$$

Question 13 A

$$\frac{dV}{dt}=0.2 \qquad V=4h^3 \Rightarrow \frac{dV}{dh}=12h^2$$

$$\frac{dV}{dt}=\frac{dV}{dh}\times\frac{dh}{dt}$$

$$0.2=12h^2\times\frac{dh}{dt}$$

$$\frac{dh}{dt}=\frac{0.2}{12h^2}=\frac{1}{60h^2}$$

Question 14 D

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

$$\frac{dy}{dx}=\frac{dy}{du}\times\frac{du}{dx}$$

Let $u=\frac{x}{2} \Rightarrow \frac{du}{dx}=\frac{1}{2}$

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

$$\frac{dy}{dx}=\frac{1}{\frac{1}{2}\sqrt{4-x^2}}\times\left(\frac{1}{2}\right)$$

$$\frac{dy}{dx}=\frac{1}{\sqrt{4-x^2}}=(4-x^2)^{-\frac{1}{2}}$$

$$\frac{d^2y}{dx^2}=-\frac{1}{2}(4-x^2)^{-\frac{3}{2}}\times(-2x)$$

$$\frac{dy}{dx}=x(4-x^2)^{-\frac{3}{2}}$$

Simplify $\frac{dy}{dx}$ before taking second derivative

Question 15 D

Factorise denominator

$$\frac{x+2}{x^3+2x}=\frac{x+2}{x(x^2+2)}$$

$$\equiv\frac{A}{x}+\frac{Bx+C}{x^2+2}$$

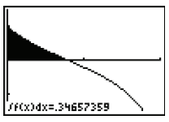
Quadratic in denominator has no linear factors.

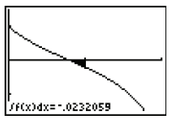
Question 16 B

Draw graph of $f(x)=\frac{\cos 2x}{(1+\sin 2x)}$ on calculator. (Must use brackets in denominator) Graph cuts x-axis at x-axis at $x=\frac{\pi}{4}$

Must split integral into $\int_0^{\frac{\pi}{4}}\frac{\cos 2x}{1+\sin 2x}dx-\int_{\frac{\pi}{4}}^{1}\frac{\cos 2x}{1+\sin 2x}dx$

From calculator





Area = 0.3466 – (–0.0232) = 0.3698