

Solutions

YEAR 11 SPECIALIST MATHS

UNIT 1 MEGA SURPRISE QUICK EXAM PREPPER QUIZ

1	$\frac{5k^2 - 5k}{k^2 - 1} \times \frac{k+1}{k-1}$ is equal to: A $\frac{5(k+1)}{k-1}$ B $\frac{5k}{k-1}$ C $\frac{-5k}{k-1}$ D $\frac{-5k}{k+1}$ E $5k$	$= \frac{5k \cancel{(k-1)}}{\cancel{(k-1)}(k+1)} \times \frac{k+1}{k-1}$ $= \frac{5k^2}{k-1}$	
2	$\frac{x+8}{(x-1)(x+2)^2}$ is equal to: A $\frac{1}{x-1} - \frac{1}{x+2} - \frac{2}{(x+2)^2}$ B $\frac{1}{(x+2)^2} + 8$ C $\frac{1}{x-1} - \frac{2}{(x+2)^2}$ D $\frac{1}{x-1} - \frac{1}{(x+2)^2}$ E $\frac{1}{x-1} - \frac{x+8}{(x+2)^2}$	$\frac{x+8}{(x-1)(x+2)^2} = \frac{A}{(x-1)} + \frac{B}{(x+2)} + \frac{C}{(x+2)^2}$ $\frac{x+8}{(x-1)(x+2)^2} = \frac{A(x+2)^2 + B(x+2)(x-1) + C(x-1)}{(x-1)(x+2)^2}$ $\textcircled{1} \quad x+8 = A(x+2)^2 + B(x+2)(x-1) + C(x-1)$ let $x=1$, let $x=-2$ $9 = A(3)^2 + 6 = 9A$ $A = 1$ $C = -2$ SUB A AND C INTO $\textcircled{1}$ $x+8 = (x+2)^2 + B(x+2)(x-1) - 2(x-1)$ $x+8 = x^2 + 4x + 4 + B(x^2 + x - 2) - 2x + 2$ $x+8 = x^2 + 2x + 6 + B(x^2 + x - 2)$ $0 = (x^2 + x - 2) + B(x^2 + x - 2)$ $-(x^2 + x - 2) = B(x^2 + x - 2)$ $\therefore B = -1$	
3	The 10th term of the sequence 12, 6, 3, ... is: A $\frac{3}{32}$ B $\frac{1}{32}$ C $\frac{9}{128}$ D $\frac{1}{128}$ E $\frac{3}{128}$	$t_{10} = ?$	

$$a = 12$$

$$r = \frac{1}{2}$$

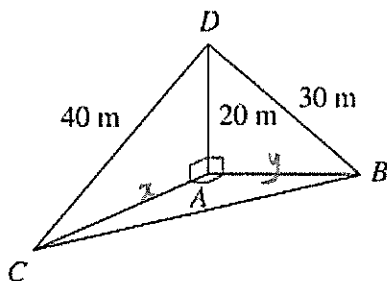
$$t_n = ar^{n-1}$$

$$= 12 \times \left(\frac{1}{2}\right)^9$$

$$= 12 \times \frac{1}{2^9} = \frac{12}{512} = \frac{6}{256} = \frac{3}{128}$$

4

A vertical mast, AD , of height 20 m is supported by two cables attached to the ground at C and B as shown in the diagram. $\angle CAB$ is a right angle. Cable CD is of length 40 m and cable BD is of length 30 m.



The angle ACB , to the nearest degree, is:

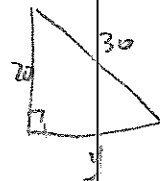
- A 48°
 B 33°
 C 57°
 D 60°
 E 42°

$$40^2 = x^2 + 20^2$$

$$1600 = x^2 + 400$$

$$1200 = x^2$$

$$x = \sqrt{1200}$$



$$30^2 = y^2 + 20^2$$

$$900 = y^2 + 400$$

$$500 = y^2$$

$$y = \sqrt{500}$$

5

$\tan 2\theta (1 + \operatorname{cosec} 2\theta)$ is equal to:

A $\tan \theta$

B $-\tan 2\theta - 1$

C $\frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}$

D $-\sin 2\theta$

E $\cot \theta$

$$= \frac{\sin 2\theta}{\cos 2\theta} \left(\frac{\sin 2\theta + 1}{\sin 2\theta} \right)$$

$$= \frac{\sin^2 2\theta + \sin 2\theta}{\cos 2\theta \sin 2\theta}$$

$$= \frac{\sin^2 2\theta + 1}{\cos 2\theta}$$



$$\tan \theta = \frac{\sqrt{500}}{\sqrt{1200}}$$

$$\tan \theta = \frac{10\sqrt{5}}{10\sqrt{12}}$$

$$\tan \theta = \frac{\sqrt{5}}{\sqrt{12}}$$

$$\tan \theta = \frac{\sqrt{15}}{6}$$

6

$\frac{\sqrt{6}}{2}(1+i)$ can be expressed in polar form as:

A $\sqrt{3}\operatorname{cis}\left(\frac{-\pi}{4}\right)$

B $\sqrt{3}\operatorname{cis}\left(\frac{-7\pi}{4}\right)$

C $-\sqrt{3}\operatorname{cis}\left(\frac{-\pi}{4}\right)$

D $-\sqrt{3}\operatorname{cis}\left(\frac{-7\pi}{4}\right)$

E $\sqrt{3}\operatorname{cis}\left(\frac{7\pi}{4}\right)$

$$= \frac{2\sin \theta + \cos \theta + \sin^2 \theta + \cos^2 \theta}{\cos^2 \theta - \sin^2 \theta}$$

$$= \frac{(\sin \theta + \cos \theta)^2}{(\cos \theta - \sin \theta)(\cos \theta + \sin \theta)}$$

$$= \frac{\sin \theta + \cos \theta}{\cos \theta - \sin \theta}$$

$$= \frac{\sqrt{6}}{2} + \frac{\sqrt{6}}{2}i$$

$$r = \sqrt{\left(\frac{\sqrt{6}}{2}\right)^2 + \left(\frac{\sqrt{6}}{2}\right)^2}$$

$$= \sqrt{\frac{6}{4} + \frac{6}{4}}$$

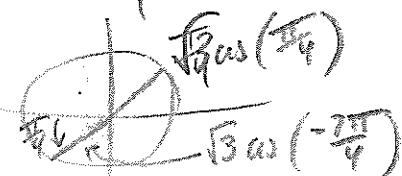
$$= \sqrt{\frac{12}{4}}$$

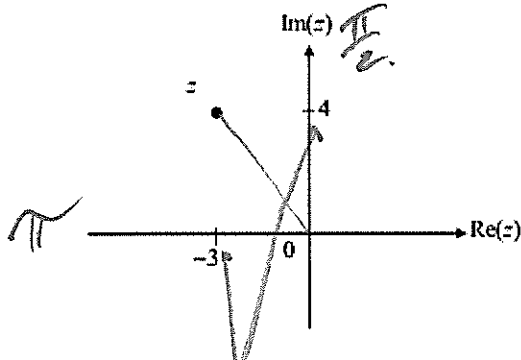
$$= \sqrt{3}$$

$$\tan \theta = \frac{\frac{\sqrt{6}}{2}}{\frac{\sqrt{6}}{2}}$$

$$\tan \theta = 1$$

$$\theta = \frac{\pi}{4}$$



7	A curve is parameterised by the equations $x = 3t + 2$ and $y = 9t^2 + 6t + 1$, where $t \geq 0$. The Cartesian equation of the curve is: A $y = (x+1)^2$ B $y = (x-1)^2$ C $y = x^2 - 2x - 1$ D $y = x^2 - 2x - 2$ E $y = x^2 - 2x - 3$	$t = \frac{x-2}{3}$ $y = 9\left(\frac{x-2}{3}\right)^2 + 6\left(\frac{x-2}{3}\right) + 1$ $y = \frac{9(x^2 - 4x + 4)}{9} + 2x - 4 + 1$ $y = x^2 - 4x + 4 + 2x - 4 + 1$ $y = x^2 - 2x + 1$ $y = (x-1)^2$
8	A parabola is defined as being the locus of points $P(x, y)$ that satisfy $FP = MP$, given coordinates $F(5, 0)$ and where MP is the perpendicular distance from the point $P(x, y)$ to the line with equation $x = -5$. The parabola has equation: A $y^2 = 20x$ B $y = 5x^2$ C $y = 20x^2$ D $x^2 = 20y$ E $y^2 = 4x$	$FP = \sqrt{(x-5)^2 + y^2}$ $MP = \sqrt{(x+5)^2 + (y-y)^2}$ $FP = MP$ $\sqrt{(x-5)^2 + y^2} = \sqrt{(x+5)^2}$ $x^2 - 10x + 25 + y^2 = x^2 + 10x$ $-20x + y^2 = 0$ $y^2 = 20x$
9	The complex number z shown in the diagram is best represented by:  A $5 \text{ cis } (0.93)$ B $5 \text{ cis } (126.87)$ C $5 \text{ cis } (2.21)$ D $25 \text{ cis } (126.87)$ E $25 \text{ cis } (2.21)$	$3^2 + 4^2 = 5^2$ $\therefore r = 5$

10

If $\sin x + b^2 \cos x = r \cos(x + \alpha)$, where $b \in \mathbb{R} \setminus \{0\}$ and α and r are positive constants, then r and $\tan \alpha$ in terms of b are:

* ☒ A $r = \sqrt{b^4 + 1}$, $\tan \alpha = \frac{-1}{b^2}$

B $r = \sqrt{b^2 + 1}$, $\tan \alpha = -b^2$

C $r = 1 + b^2$, $\tan \alpha = \frac{1}{b^2}$

* ☐ D $r = \sqrt{b^4 + 1}$, $\tan \alpha = b^2$

* ☐ E $r = \sqrt{b^4 + 1}$, $\tan \alpha = -b^2$

$$r^2 = 1^2 + (b^2)^2$$

$$r = \sqrt{1 + b^4}$$

*

$$\tan \alpha = \frac{-1}{b^2}$$

END OF UNIT 1 MEGA SURPRISE QUICK EXAM PREPPER QUIZ

