

## Questions 21 - 40

### FORMULAE LIST

#### Circle:

The equation  $x^2 + y^2 + 2gx + 2fy + c = 0$  represents a circle centre  $(-g, -f)$  and radius  $\sqrt{g^2 + f^2 - c}$ .

The equation  $(x-a)^2 + (y-b)^2 = r^2$  represents a circle centre  $(a, b)$  and radius  $r$ .

#### Scalar Product:

$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}| |\mathbf{b}| \cos \theta$ , where  $\theta$  is the angle between  $\mathbf{a}$  and  $\mathbf{b}$

or  $\mathbf{a} \cdot \mathbf{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$  where  $\mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$  and  $\mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$ .

#### Trigonometric formulae:

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

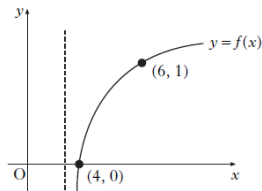
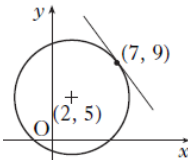
#### Table of standard derivatives:

$f(x)$	$f'(x)$
$\sin ax$	$a \cos ax$
$\cos ax$	$-a \sin ax$

#### Table of standard integrals:

$f(x)$	$\int f(x) dx$
$\sin ax$	$-\frac{1}{a} \cos ax + c$
$\cos ax$	$\frac{1}{a} \sin ax + c$

<b>21</b> Show that $(x - 1)$ is a factor of $x^3 - 3x + 2$ . Hence or otherwise factorise $x^3 - 3x + 2$ fully.	
<b>22</b> $2x^2 + 4x + 7$ is expressed in the form $2(x + p)^2 + q$ . What is the value of $q$ .	
<b>23</b> If $\log_4 12 - \log_4 x = \log_4 6$ , what is the value of $x$ ?	
<b>24</b> Solve $2\cos x = \sqrt{3}$ for $x$ , where $0 \leq x < 2\pi$ .	
<b>25</b> If the exact value of $\cos x$ is $\frac{1}{\sqrt{5}}$ , find the exact value of $\cos 2x$ .	
<b>26</b> Given that $f(x) = (4 - 3x^2)^{-\frac{1}{2}}$ on a suitable domain, find $f'(x)$ .	
<b>27</b> Find the coordinates of the stationary points on the curve $f(x) = x^3 - 3x + 2$ and determine their nature.	
<b>28</b> Find $\int (4x^{\frac{1}{2}} + x^{-3}) dx$ , where $x > 0$ .	
<b>29</b> The graph of $y = f(x)$ passes through the point $(\frac{\pi}{9}, 1)$ . If $f'(x) = \sin(3x)$ express $y$ in terms of $x$ .	
<b>30</b> Write $\sin x - \cos x$ in the form $k\sin(x - a)$ stating the values of $k$ and $a$ where $k > 0$ and $0 \leq a \leq 2\pi$ .	

<p><b>31</b> Functions <math>f</math> and <math>g</math> are given by <math>f(x) = 3x + 1</math> and <math>g(x) = x^2 - 2</math>. Find <math>f(g(x))</math> and <math>g(f(x))</math>.</p>	
<p><b>32</b> The diagram shows the graph of <math>y = f(x)</math> where <math>f</math> is a logarithmic function. What are the values of <math>a</math> and <math>b</math> for <math>f(x) = \log_a(x - b)</math>?</p>	
<p><b>33</b> The vectors <math>\mathbf{u} = \begin{pmatrix} k \\ -1 \\ 1 \end{pmatrix}</math> and <math>\mathbf{v} = \begin{pmatrix} 0 \\ 4 \\ k \end{pmatrix}</math> are perpendicular. What is the value of <math>k</math>?</p>	
<p><b>34</b> D, E and F have coordinates <math>(10, -8, -15)</math>, <math>(1, -2, -3)</math> and <math>(-2, 0, 1)</math> respectively. Show that D, E and F are collinear and find the ratio in which E divides DF.</p>	
<p><b>35</b> Prove that <math>\frac{\cos^3 x}{1 - \sin^2 x} = \cos x</math>.</p>	
<p><b>36</b> The line L passes through the point <math>(-2, -1)</math> and is parallel to the line with equation <math>5x + 3y - 6 = 0</math>. What is the equation of L?</p>	
<p><b>37</b> Triangle PQR has vertices at <math>P(-3, -2)</math>, <math>Q(-1, 4)</math> and <math>R(3, 6)</math>. PS is a median. What is the gradient of PS?</p>	
<p><b>38</b> The diagram shows a circle, centre <math>(2, 5)</math> and a tangent drawn at the point <math>(7, 9)</math>. What is the equation of this tangent?</p>	
<p><b>39</b> A sequence is generated by the recurrence relation <math>u_{n+1} = 0.4u_n - 240</math>. What is the limit of this sequence as <math>n \rightarrow \infty</math>?</p>	
<p><b>40</b> Calculate the shaded area enclosed by the curve <math>y = x^3(3 - x)</math> and the <math>x</math>-axis between <math>x = 0</math> and <math>x = 3</math>.</p>	