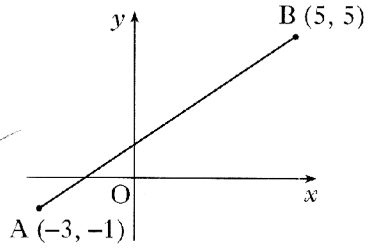
ALL questions should be attempted.

Marks

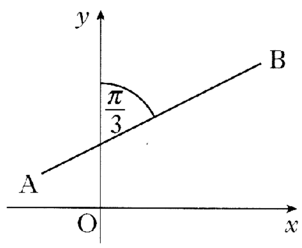
1. Show that $x = 2$ is a root of the equation $y = 2x^3 + x^2 - 13x + 6 = 0$ and hence, or otherwise, find the other roots. **4**

2. A and B are the points $(-3, -1)$ and $(5, 5)$. Find the equation of the perpendicular bisector of AB. **4**

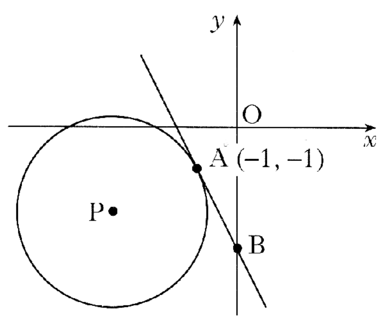


3. The point $P(-1, 7)$ lies on the curve with equation $y = 5x^2 + 2$. Find the equation of the tangent to the curve at P. **3**

4. The line AB makes an angle of $\frac{\pi}{3}$ radians with the y-axis, as shown in the diagram. Find the exact value of the gradient of AB. **2**



5. (*a*) The diagram shows a circle, centre P, with equation $x^2 + y^2 + 6x + 4y + 8 = 0$. Find the equation of the tangent at the point A $(-1, -1)$ on the circle. **4**



(*b*) The tangent crosses the y-axis at B. Find the equation of the circle with AB as diameter. **3**

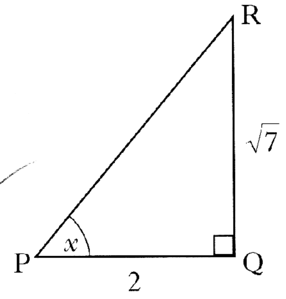
Marks

6. $f(x) = \sqrt{3}\sin x° - \cos x°$

(*a*) Express $f(x)$ in the form $k\sin(x - a)°$ where $k > 0$ and $0 \leq a < 360$. **4**

(*b*) Hence solve the equation $f(x) = \sqrt{2}$ in the interval $0 \leq a < 360$. **3**

7. Using triangle PQR, as shown, find the exact value of $\cos 2x$. **3**



8. Functions f and g are defined on the set of real numbers by

$$f(x) = x - 1$$
$$g(x) = x^2.$$

(*a*) Find formulae for

(i) $f(g(x))$

(ii) $g(f(x))$. **3**

(*b*) The function h is defined by $h(x) = f(g(x)) + g(f(x))$.
Show that $h(x) = 2x^2 - 2x$ and sketch the graph of h. **3**

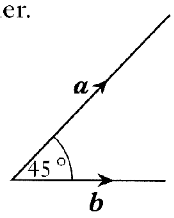
(*c*) Find the area enclosed between this graph and the x-axis. **4**

9. Find $\int \frac{x^2 - 5}{x\sqrt{x}}\,dx$. **4**

Marks

10. The diagram shows two vectors $\boldsymbol{a}$ and $\boldsymbol{b}$, with $|\boldsymbol{a}| = 3$ and $|\boldsymbol{b}| = 2\sqrt{2}$.

These vectors are inclined at an angle of 45° to each other.



(*a*) Evaluate (i) $\boldsymbol{a.a}$

(ii) $\boldsymbol{b.b}$

(iii) $\boldsymbol{a.b}$ **2**

(*b*) Another vector $\boldsymbol{p}$ is defined by $\boldsymbol{p} = 2\boldsymbol{a} + 3\boldsymbol{b}$.

Evaluate $\boldsymbol{p.p}$ and hence write down $|\boldsymbol{p}|$. **4**

[*END OF QUESTION PAPER*]