Start here for Question Number: 6

6a) $f(x)=(x+2)(x^2+x)$

i) $f'(x) = (x^2+4) + (x+2) \times 2x$

$= x^2+4+2x(x+2)$

let $f'(x)=0$ to find st pts

$x^2+4+2x(x+2)=0$

$x^2+4+2x^2+4x=0$

$3x^2+4x+4=0$

$3x^2+8=0$

$3x^2=-8$

$x^2=-\frac{8}{3}$

explanation

There is no value for x since you cannot factorise this. Therefore since $f'(x)=0$ has no solutions, there are no st pts

Since you cannot square root a negative number, there is no solution for x. Since there is no solution for x, then when $f'(x)=0$, there are no st pts.

ii) $f''(x) = x^2+4+2x^2+4x$

$= 3x^2+4x+4$

$f''(x) = 6x+4$

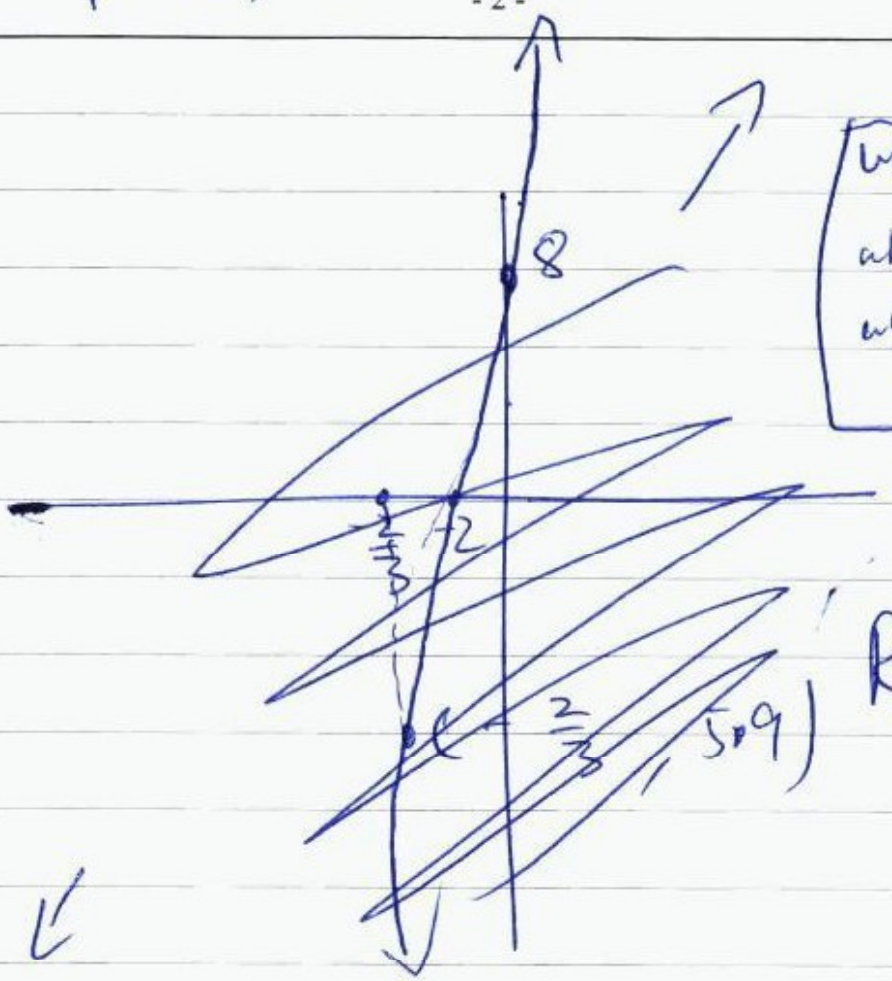
let $f''(x)<0$ to find values for which $f(x)$ is concave down

$6x+4<0$

$6x<-4$

$x<-\frac{2}{3}$ is where $f(x)$ is concave down

(iii)



when $x \to \infty, y \to \infty$

when $x \to -\infty, y \to -\infty$

when $x \to 0, y \to 8$

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y intercept when $x = 0$

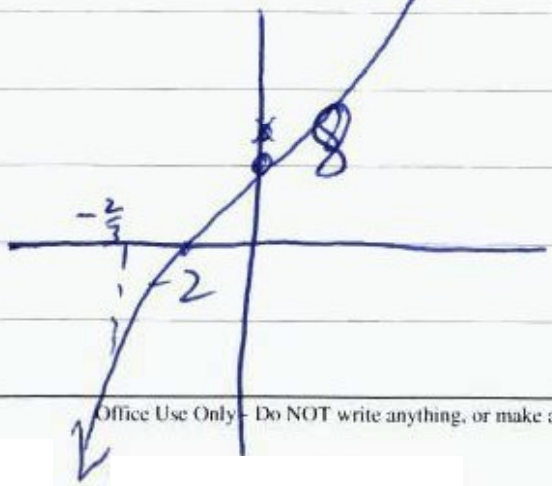
$= (2)(4)$

$= 8$

x intercept when $y = 0$

$(x+2)(x^2+4) = 0$

$x = -2$



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b)

i) In $\triangle OPQ$

$\angle OPQ = \angle OQB$ (base angles of isosceles triangle due to equal radii of PO and OQ)

PQ bisects $\angle OPQ = \angle OQB$

$\therefore \angle OPQ = \angle OQB = 45^\circ$

$\therefore \angle POQ = 180 - 45 - 45$

$= 90^\circ$

$= \frac{\pi}{2}$

ii) In $\triangle OPT, \triangle OQT$

① $\angle OPT = \angle OQT$ (given) both perpendicular lines drawn to OP, OQ)

② $PO = OQ$ (equal radii drawn from centre O)

③ $OT = OT$ (common side)

$\therefore \triangle OPT \equiv \triangle OQT$ (SAS)

You may ask for an extra Writing Booklet if you need more space to answer question 6.

Start here.

iii) Finding length of PT

PT = TQ (corresponding sides of congruent triangles)

PT = TQ = 5 cm (equal radii from external centre O similar to internal centre O)

iv) Shaded region = $\frac{1}{2}bh - \frac{\pi r^2}{2}$

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