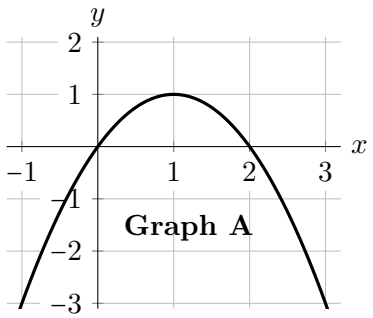
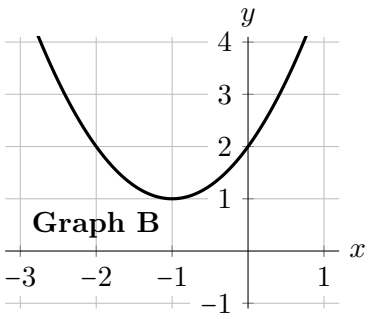
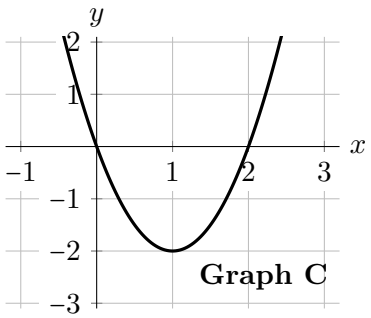
3. [6 points] For each of the following equations, bubble in the letter of the corresponding graph or bubble in **D** if it does not correspond to any of the shown graphs. Use pencil in case you need to change your answer. *A graph may appear as an answer multiple times.*

GRAPHS A, B, C:







(i) $y = -(x-1)^2 + 1$

◯ A ◯ B ◯ C ◯ D (None)

Solution: Since the leading coefficient is negative, we see that this function is concave down. It is written in vertex form, so we can read off that it has a vertex at $(1, 1)$. This looks like it lines up with Graph A. To verify, we can plug in $x = 0$ or $x = 2$ to check that they are zeros or rewrite $y = -(x-1)^2 + 1$ in factored form as $-(x^2 - 2x + 1) + 1 = -(x^2 - 2x) = -x(x-2)$.

(ii) $y = x(x-2)$

◯ A ◯ B ◯ C ◯ D (None)

Solution: Since the leading coefficient is positive, we see that this function is concave up. It is written in factored form, so we can read off that it has zeros at $x = 0, 2$. This sounds like it could match Graph C. To check, we can plug in $x = 1$: this gives a value of $1(1-2) = -1$. However, we see that the vertex of Graph C is at $(1, -2)$ not $(1, -1)$, so this is not a match.

(iii) $y = (x+1)^2 + 1$

◯ A ◯ B ◯ C ◯ D (None)

Solution: This function is concave up and has a vertex at $(-1, 1)$. It has no zeros, so we can check another point to make sure that Graph B is a match. For example, we have that at $x = 0$, $y = (0+1)^2 + 1 = 2$, which does match Graph B.

(iv) $y = 2(x-1)^2 - 2$

◯ A ◯ B ◯ C ◯ D (None)

Solution: This function is concave up and has a vertex at $(1, -2)$, so it looks like it could match Graph C. To check, we could plug in $x = 0$ or $x = 2$ to confirm that they are zeros or rewrite the function in factored form as $2(x^2 - 2x + 1) - 2 = 2(x^2 - 2x) = 2x(x-2)$.

(v) $y = x(x+2)+2$

◯ A ◯ B ◯ C ◯ D (None)

Solution: This function is not written in either factored or vertex form. If we rewrite it in standard form as x^2+2x+2, we see it doesn't factor. However, we might see that this is the same as $(x+1)^2+1$ from part (iii) which matched Graph B. Alternatively, we can realize that it is a shift up by 2 of $x(x+2)$. The function $x(x+2)$ is concave up and has zeros at $x=-2,0$. Therefore, $x(x+2)+2$ should be concave up and go through the points $(-2,2)$ and $(0,2)$. This looks like it should match Graph B. To check, we plug in $x=-1$ to get a y-value of $-1(-1+2)+2=-1+2=1$, which does match Graph B.

(vi) $y = 2x(x-2)$

◯ A ◯ B ◯ C ◯ D (None)

Solution: This function is concave up and has zeros at $x=0,2$. This sounds like it could match Graph C. To confirm, we can plug in $x=1$ to get a y-value of $2(1)(1-2)=2(-1)=-2$, which does match Graph C.