**FURTHER INTERSECTIONS OF LINES and CURVES.**

Find the intersections of the following pairs of graphs using algebraic methods. **You will need to use your graphics calculators because the intersections will not always be rational numbers. Be sure to round off numbers appropriately.**

***1. y = x2***

 ***y = x + 5***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***2. y = x2 – 20***

 ***y = x – 4***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***3. x2 + 4y – 20 = 0***

 ***y = x – 5***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***4. x2 + 10y – 60 = 0***

 ***y = 3x – 4***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***5.\* If y = 2x + c is a***

 ***tangent to y = x2 + 3***

 ***find the value of c.***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***6.\* If y = 3x + c is a***

 ***tangent to the parabola y = x2 + 4y – 20***

 ***find the value of c.***

***7. y = 8 (or xy = 8)***

 ***x***

 ***y = x + 3***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***8. y = 1 + 5***

 ***x***

 ***y = x – 4***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***9. y = 6 – 9***

 ***x***

 ***y = 2 – x***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***10. y = 20 – 4***

 ***x***

 ***y = 2x – 3***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***11.\* If y = x + c is a***

 ***tangent to y = 8 – 2***

 ***x***

 ***find c.***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***12.\* If y = mx + 2 is a***

 ***tangent to y = 3***

 ***x***

 ***find the value of m.***

***13. x2 + y2 = 25***

 ***y = x + 2***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***14. x2 + y2 = 4***

 ***y = 2x – 1***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***15. y2 + x2 = 49***

 ***y = 3x + 2***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***16\* If y = x + c is a***

 ***tangent to x2 + y2 = 9***

 ***find the possible***

 ***values of c.***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***17\*. If y = x + c is a***

 ***tangent to x2 + y2 = 4***

 ***find the possible***

 ***values of c.***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***18. Find where the line***

 ***4y – 7x – 11 = 0***

***crosses the x and y axes.***

 ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***19. Find where the line***

 ***y = 7x – 6.38***

***crosses the x axis. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***20 Find where the line***

 ***y = 3x + 7.6295***

***crosses the x axis.***

***SOLUTIONS.***

***1. y = x2 ∩ y = x + 5***

***x2 – x – 5 = 0***

***x = 2.79 or -1.79***

***y = 7.79 or 3.21***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***2. y = x2 – 20 ∩ y = x – 4***

***x2 – 20 = x – 4***

***x2 – x – 16 = 0***

***x = 4.53 or -3.53***

***y = 0.53 or -7.53***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***3. x2 + 4y – 20 = 0***

 ***∩ y = x – 5***

***x2 + 4(x – 5) – 20 = 0***

***x2 + 4x – 20 – 20 = 0***

***x2 + 4x – 40 = 0***

***x = 4.63 or -8.63***

***y = -0.37 or -13.63***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***4. x2 + 10y – 60 = 0***

 ***∩ y = 3x – 4***

***x2 + 10(3x – 4) – 60 = 0***

***x2 + 30x – 40 – 60 = 0***

***x2 + 30x – 100 = 0***

***x = 3.03 or -33.03***

***y = 5.09 or 95.09***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***5.\* If y = 2x + c is a***

 ***tangent to y = x2 + 3***

 ***find the value of c.***

***x2 + 3 = 2x + c***

***x2 – 2x + (3 – c) = 0***

***To be a tangent ∆ = 0 so***

***4 – 4(3 – c) = 0***

***4 – 12 + 4c = 0***

***4c = 8 so c = 2***

***6.\* If y = 3x + c is a***

 ***tangent to the parabola***

 ***y = x2 + 4y – 20***

 ***find the value of c.***

***x2 + 4(3x + c) – 20 = 0***

***x2 + 12x + (4c – 20) = 0***

***To be a tangent ∆ = 0 so***

***144 – 4(4c – 20) = 0***

***144 – 16c + 80 = 0***

***64 = 16c so c = 4***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***7. xy = 8 ∩ y = x + 3***

***x(x + 3) = 8***

***x2 + 3x – 8 = 0***

***x = 1.702 or -4.702***

***y = 4.702 or -1.702***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***8. y = 1 + 5 ∩ y = x – 4***

 ***x***

***x – 4 = 1 + 5***

 ***x***

***x2 – 4x = 1 + 5x***

***x2 – 9x – 1 = 0***

***x = 9.11 or -0.11***

***y = 5.11 or -4.11***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***9. y = 6 – 9 ∩ y = 2 – x***

 ***x***

 ***2 – x = 6 – 9***

 ***x***

 ***2x – x2 = 6 – 9x***

 ***0 = x2 – 11x + 6***

***x = 10.42 or 0.576***

***y = -8.42 or 1.424***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***10. y = 20 – 4 ∩ y = 2x – 3***

 ***x***

 ***2x – 3 = 20 – 4***

 ***x***

***2x2 – 3x = 20x – 4***

***2x2 – 23x + 4 = 0***

***x = 11.32 or 0.177***

***y = 19.64 or -2.646***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***11.\* If y = x + c is a***

 ***tangent to y = 8 – 2***

 ***x***

 ***find c.***

***x + c = 8 – 2***

 ***x***

***x2 + cx = 8x – 2***

***x2 +(c – 8)x + 2 = 0***

***To be a tangent ∆ = 0 so***

***(c – 8)2 – 4 × 2 = 0***

***(c – 8)2 = 8***

***c – 8 = 2.828 or – 2.828***

***c = 10.828 or 5.172***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***12.\* If y = mx + 2 is a***

 ***tangent to y = 3***

 ***x***

 ***find the value of m.***

***mx + 2 = 3***

 ***x***

***mx2 + 2x – 3 = 0***

***To be a tangent ∆ = 0 so***

***4 – 4m(-3) = 0***

***4 = 12m***

***m = ⅓***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***13. x2 + y2 = 25***

 ***∩ y = x + 2***

***x2 + (x + 2)2 = 25***

***x2 + x2 + 4x + 4 – 25 = 0***

***2x2 + 4x – 21 = 0***

***x = 2.39 or -4.39***

***y = 4.39 or -2.39***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***14. x2 + y2 = 4***

 ***∩ y = 2x – 1***

***x2 + (2x – 1)2 = 4***

***x2 + 4x2 – 4x + 1 – 4 = 0***

***5x2 – 4x – 3 = 0***

***x = 1.272 or -0.472***

***y = 1.544 or -1.944***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***15. y2 + x2 = 49***

 ***∩ y = 3x + 2***

***x2 + (3x + 2)2 = 49***

***x2 + 9x2 + 12x + 4 – 49 = 0***

***10x2 + 12x – 45 = 0***

***x = 1.605 or -2.805***

***y = 6.815 or -3.61***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***16\* If y = x + c is a***

 ***tangent to x2 + y2 = 9***

 ***find the possible***

 ***values of c.***

***x2 + (x + c)2 = 9***

***x2 + x2 + 2cx + c2 – 9 = 0***

***2x2 + 2cx + (c2 – 9) = 0***

***To be a tangent ∆ = 0 so***

***4c2 – 4 × 2 × (c2 – 9) = 0***

***4c2 – 8c2 + 72 = 0***

 ***72 = 4c2***

 ***c2 = 18***

***c = 4.243 or – 4.243***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***17\*. If y = x + c is a***

 ***tangent to x2 + y2 = 4***

 ***find the possible***

 ***values of c.***

***x2 + (x + c)2 = 4***

***x2 + x2 + 2cx + c2 – 4 = 0***

***2x2 + 2cx + (c2 – 4) = 0***

***To be a tangent ∆ = 0 so***

***4c2 – 4 × 2 × (c2 – 4) = 0***

***4c2 – 8c2 + 32 = 0***

 ***32 = 4c2***

 ***c2 = 8***

***c = 2.828 or – 2.828***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***18. Find where the line***

 ***4y – 7x – 11 = 0***

***crosses the x and y axes.***

***Crosses x axis if y = 0 so***

 ***-7x – 11 = 0***

 ***-11 = 7x***

 ***x = -1.57***

***point is (-1.57, 0)***

***Crosses y axis if x = 0 so***

***4y – 11 = 0***

 ***y = 2.75***

***point is (0, 2.75)***

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***19. Find where the line***

 ***y = 7x – 6.38***

***crosses the x axis.***

***Crosses x axis if y = 0 so***

***7x – 6.38 = 0***

 ***7x = 6.38***

 ***x = 0.911***

***point is (0.911, 0)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***20 Find where the line***

 ***y = 3x + 7.6295***

***crosses the x axis.***

***Crosses x axis if y = 0 so***

***3x – 7.6295 = 0***

 ***3x = 7.6295***

 ***x = 2.543***

***point is (2.543, 0)***